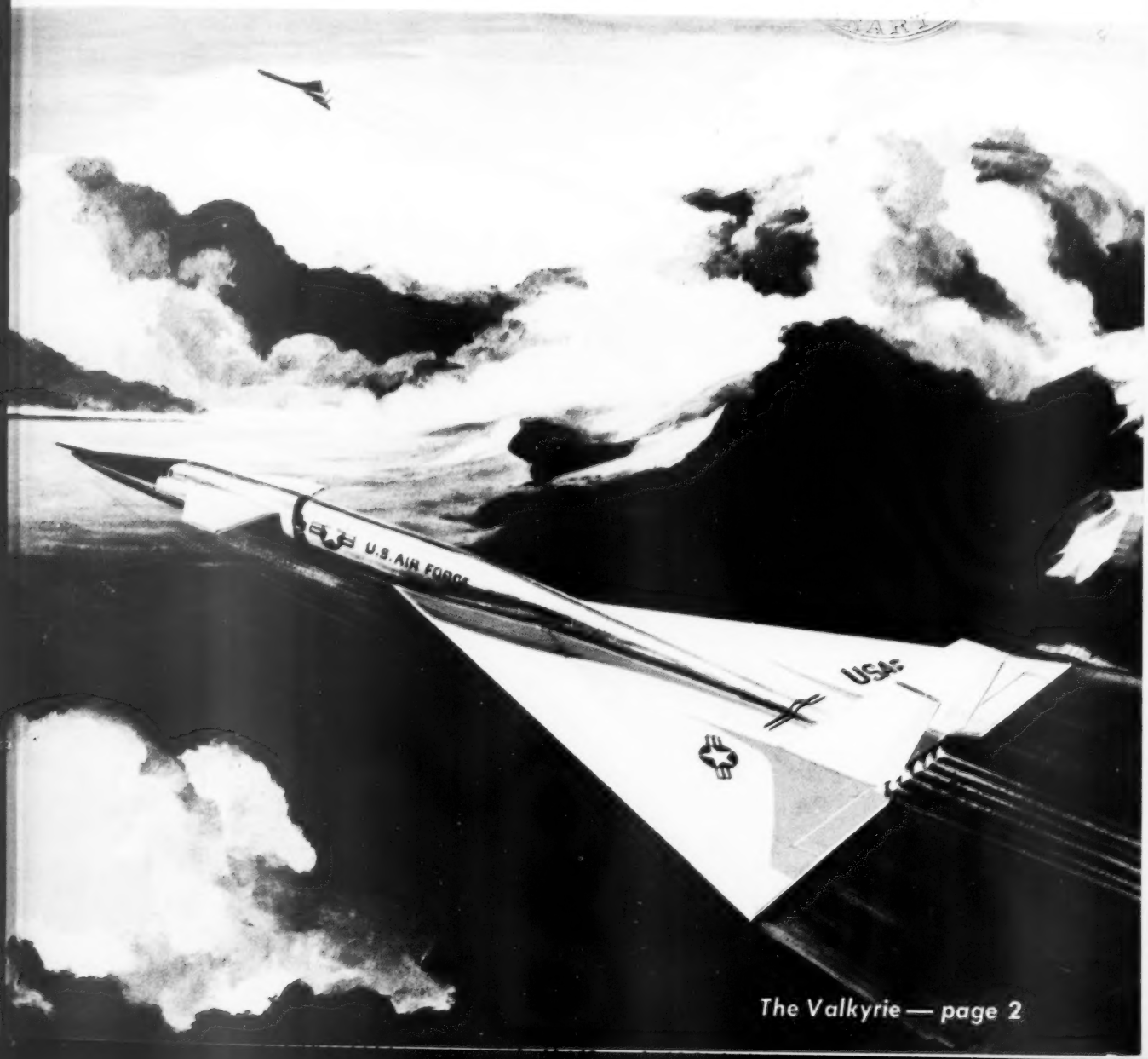
JUNE 1960

THE Airman

OFFICIAL JOURNAL OF THE AIR FORCE



The Valkyrie — page 2

Photo by J. Abisror, USIS

USAF doctor Delbert Dayton, stationed at Sidi Slimane AB, aids a Moroccan child injured in the Agadir disaster. See page 33.

. . . Inasmuch as ye have done it unto one of the least of these my brethren, ye have done it unto me.

St. Matthew 25:40

THE Airman

OFFICIAL JOURNAL OF THE AIR FORCE

Volume IV, Number 6 June 1960

CONTENTS

THE VALKYRIE 2

YOUR PERSONAL FLIGHT PLAN 8

FEINT AT PAS DE CALAIS 12

OUR SISTER CITIES 16

SUPERSONIC SCHOLARS 19

DANCE OF THE HEAVIES 24

TOMORROW'S OFFICERS 26

THE SOUNDING FIRMAMENT 36

NO ROOM FOR AMATEURS 44

DEPARTMENTS

LETTERS TO THE EDITOR . 1

YOU SHOULD KNOW . . . 14

SLANTS ON SPACE 23

AIRMAN'S WORLD 31

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USAF PERIODICAL 30-15

SUBSCRIPTIONS

THE AIRMAN is available on subscription for $3.50 per year domestic, $4.75 foreign, 35¢ per copy, through the Superintendent of Documents, Government Printing Office, Washington 25, D. C. No back copies can be furnished.

Editorial Office: THE AIRMAN, Room 2-206 Tempo E, 4th and Adams Drive, S. W., Washington 25, D. C. Telephone: OXford 6-7393.

THE AIRMAN is primarily a medium for the exchange of ideas and information among Air Force personnel. Readers are encouraged to submit articles, short subjects, photographs, and artwork. All contributions will be given consideration; suggestions and criticisms are welcomed. Opinions expressed by individual contributors do not necessarily reflect the official viewpoint of the Department of the Air Force. All photographs are official USAF photos unless otherwise designated.

Use of funds for printing this publication approved by the Secretary of the Air Force and the Director of the Bureau of the Budget June 9, 1959.

LETTERS TO THE EDITOR

BELATED THANKS . . .

Sir: I would like to comment on the January 11, 1944 mission to Oschersleben which was featured in your Medal of Honor series in the March issue. I had the honor to be on that mission as left waist gunner of a B-17 of the old Triangle "J" 351st Bomb Group, 408th Squadron, out of Polebrook. We departed the English coast, could see the weather was going to be rough, and expected a recall at any time. About 30 minutes in from the French coast we could see other elements turn off and head back for England. Our pilot, Capt. Don Floden, called the radio operator, TSgt. Bob Quarles, and asked if he was sure there was no recall. Bob answered in the negative and we proceeded on course. As the article states, the bandits were sitting out of range and biding their time. At just about the turning point they jumped our high and low groups and all hell broke loose. We were deputy lead of the low group and I stood frozen in fascination as the group about us began to dwindle. Bomber after bomber fell out and went into a crazy dive or exploded in a fiery ball. This was the first time in nine missions I had seen Germans come right through their own flak to press an attack. We had been through a few rough ones but this seemed to be a chapter from Dante's *Inferno.* Getting my wits about me I began to fire the trusty old calibre .50 at the attacking fighters. There was little need to apply accurate gunnery practices as the sky was full of bandits. In the heat of the air battle our right waist gunner, SSgt. Gus Bunescu, yelled over the interphone, "There's a P-51 coming under our belly to nine o'clock. Don't shoot at him." From the ball turret came the voice of SSgt. Vernon Skeen, "Look at that crazy ————. He's attacking them all alone. There must be 50 against him." This then-unknown (to us) P-51 pilot proceeded to fly circles around the Germans and broke up the attack on our element. I'm sure a cheer went up from each B-17 crew who witnessed this performance of gallantry and airmanship. He dispersed the fighters from pressing their attack and gave us all a tremendous feeling of comradeship. We didn't see him after that and to this day I never knew who

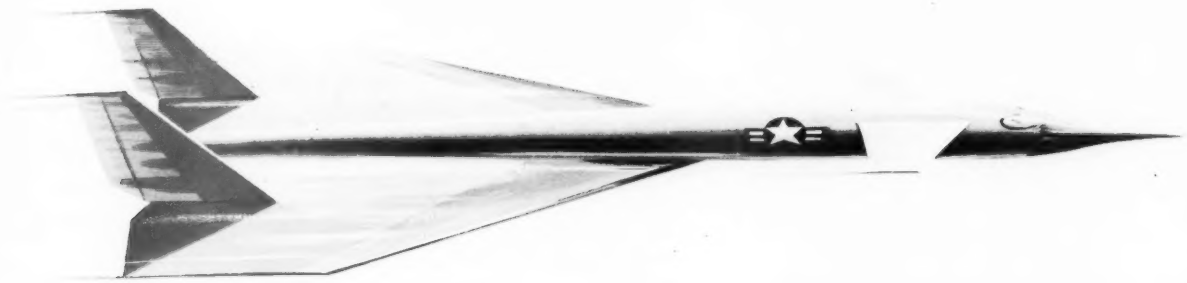
(Continued on page 15)

Courtesy North American Aviation, Inc.

THE VALKYRIE

by
MSgt. Edison T. Blair
Airman Staff

This is the story of the B-70, a prototype of which is presently being built for the USAF by North American Aviation. The B-70 Valkyrie will represent an almost unbelievable achievement in scientific and technological development. Its potential capabilities as an aerospace weapon system are of interest to every member of the Air Force.



IMAGINE yourself in an airplane taking off from England just as the sun peeps over the horizon. As the plane climbs to 70,000 feet above the Atlantic Ocean you watch the sun set again—*in the east!*

Yes, instead of rising higher, the sun sinks right back into last night. It is still dark when the plane lands in California and you dawdle three hours over another breakfast waiting for the same sun to rise on the same day so you can go about your business. You could have slept 'til noon and got to work just as early.

If you hadn't stopped and knew a way to harness in an oven the heat generated on the skin of the airplane, you could have broiled a steak for last night's supper. The air at 70,000 feet is admittedly thin, but enough air molecules scrub along the steel-clad fuselage at 2,000 miles per hour to heat it up to around 550 degrees. An oven that hot is all right for steaks, but it will burn the biscuits. Still, you don't notice the heat—modern air conditioning, y'know.

Or, imagine this airplane is a bomber on alert at a California base. The klaxon sounds, the crew scrambles, engines whine, and it blasts off. Communist troop ships have been reported an hour away from the Chinese mainland apparently enroute to a Formosa invasion. Quemoy, an island closer to Formosa than to China, is within artillery range of the Red coastal batteries, so the Reds can't have too far to go. But the California-based bomber, capable of carrying several dozen Hiroshima-type nuclear bombs, could make a pass at the invaders before they are halfway across the Straits of Formosa.

Then, suppose the alleged troop ships turn out to be shrimp boats headed for the biggest shrimp haul in history? The bomber is a manned weapon system that can turn around and go home again.

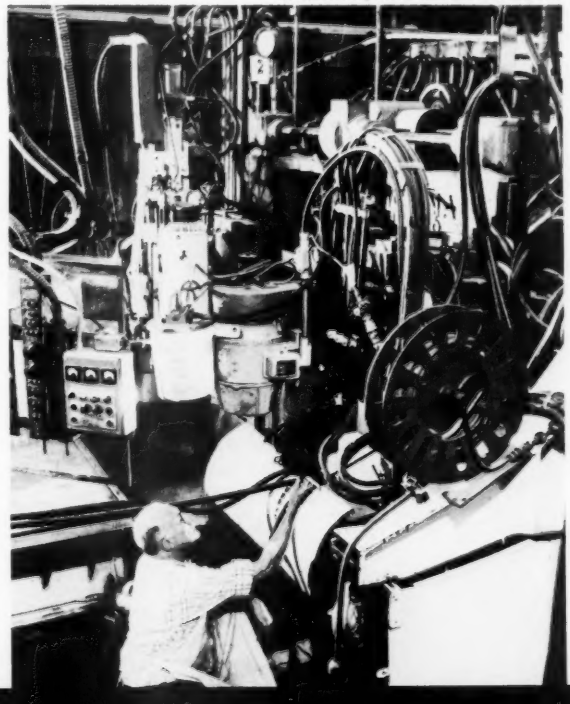
You can turn off your imagination now because this is for real. The Mach 3 (2,000 miles per hour) B-70 *Valkyrie* will be such an airplane.

According to ancient Norse legends, Valkyries were beautiful, but terrible maidens who served the war god Odin. At his bidding they rode their horses in shining armor over the battlefields daily to choose those who were to be slain and carried back to Valhalla. The B-70 *Valkyrie* will be a weapon system with man's powers of decision, able to choose targets at will.

Today, *Valkyries* are no legend—but they are not yet weapon systems either. Nevertheless, they are still a major development program, a fantastic step forward in aerodynamics, and they will be needed by the U. S. Air Force to replace aging, subsonic B-52s. Air Force Chief of Staff, General Thomas D. White, told a Congressional Preparedness Subcommittee that the B-70 is the "most advanced weapon system in the bomber field that the state of the art as of now permits, and

With pipes, tubes, conduits, and generous helpings of inventive imagination North American engineers converted this skin mill to an "unplating" machine.

Photo courtesy North American Aviation, Inc.



that is true as far in advance as we can see." He meant that nothing more advanced is on the drawing board.

Riding the shockwave of a major technological breakthrough by the National Aeronautics and Space Administration, the *Valkyrie* expands aerodynamically in three dimensions—speed, range, and altitude. The tail-first configured airplane (ducklike wings for elevator controls near the nose and a huge delta wing one-sixth of an acre in area for the back half) looks more like a missile than an airplane. It will reach any point on earth in five hours. It penetrates beyond the heat barrier. Later aircraft, using these same aerodynamic principles and properly powered, may go to Mach 4, Mach 6, or even Mach 10. A Mach 16 engine design has a patent already pending.

With a range of approximately 7,000 miles, the B-70 can go the whole distance at supersonic speeds without refueling. It operates above 70,000 feet—14 miles high. Potential enemies today have no interceptor aircraft that can survive the heat environment at such speeds and altitudes, nor can their present surface-to-air interceptor missiles reach this altitude.

Of course the enemy could, and probably will, build airplanes that go as fast, and interceptor missiles with the altitude range. They have built nuclear weapons and missiles to equal or surpass ours. But, it has been estimated that *it would cost the enemy $40 billion in five years to build defenses against the B-70.*

The Air Force's working capital toward the B-70 in the 1961 Fiscal Year is $75 million. Originally $456 million was requested for the program which was intended to put a wing of *Valkyries* in operation by 1965 at a total cost of $3.4 billion. This would have included all research and development costs. Studies on the *Valkyrie* began in 1953 although applied research work on the system didn't begin until 1955. No one denies this is an expensive piece of hardware. Will its capabilities justify the cost?

General White had the answer when he testified before a congressional subcommittee in February. He stated the requirements for a manned bomber and summed up succinctly the unique capabilities of the B-70:

With full warning of an ICBM attack on the U. S., he pointed out, there would be a maximum of a half an hour from launch to impact. If BMEWS gave approximately 15 minutes warning, local commanders could launch B-70s with less than certain information of an actual attack. If the information proved false, the aircraft could be recalled with no harm done. Conversely, local commanders couldn't launch ICBMs in counterattack with less than certain information because once fired, missiles don't come back. We can't risk firing the first shot in a war that we don't want.

Instead of a single warhead, the big bomb bays of the B-70 can carry multiple loads—any bombs now on the shelf, or new weapons not yet designed but for which there is a requirement. The *Valkyrie* is completely flexible. It can deliver anything from bullets to our biggest bomb to suit a particular situation, be it strategic bombardment or tactical cover. If nuclear weapons should be outlawed by agreement, a missile is an expensive one-way vehicle to deliver conventional explosives.

Although the bomb load of the B-70 would be its primary weapon, it could also carry an air-launched ballistic missile (ALBM), such as a version of the *Sky Bolt* now under study. There would be no advantage in arming the *Valkyrie* with the present air-breathing *Hound Dog* because the airplane would fly as fast as the missile. The hypersonic *Sky Bolt,* which will travel at Mach 5 (3,500 m.p.h.) or better, could be launched 1,000 miles from the target with a high degree of accuracy.

"The major problems in development of such a missile," says Dr. Joseph V. Charyk, Under Secretary of the Air Force, "relate to the development of the complete equipment in the aircraft, including the appropriate computational facilities which would permit an accurate determination of location and trajectory from any point at which the aircraft might happen to be."

That means that an aircraft would have to be located precisely within one-quarter of a mile. Even though the B-70 would travel that quarter of a mile in less than half a second, the bomb/navigation system originally programmed for the bomber would have such accuracy.

The *Valkyrie* has been described as a single, all-purpose weapon system readily adaptable to many uses. It could be used, for instance, for long-range interceptor missions. It could carry an enormous radar dish and thus have its own early warning system built right in. Armed with many long-range air-to-air rockets the B-70, or F-70 in this case, could stop many invaders far from our shores.

Although the *Valkyrie* is limited to operation within the earth's atmosphere it could contribute considerably to the country's space programs. The airplane would make an ideal substitute for the first stage of a space rocket, General White suggests. At 70,000 feet and a speed of Mach 3, the B-70 has the boost equivalent of an *Atlas* launched from earth. Present plans call for an *Atlas* booster as the first stage of the MIDAS (Missile Defense Alarm System). An *Atlas* booster can be used

but once, a B-70 booster system could be used over and over.

The enemy is certain to have counterparts of these satellites, and in the event of war they would become prime military targets. Knocking them down with earth-launched rockets would be a tricky affair—like trying to knock over the moving ducks in a carnival shooting gallery by firing from the back of a wooden horse on a merry-go-round moving in the opposite direction. The ducks would be much easier to pick off if you shot from a platform moving parallel, in the same direction, and at a relative speed. The B-70 could be such a moving platform from which to launch rockets.

Mobility increases the effectiveness and decreases the vulnerability of the *Minuteman* and *Polaris* missiles. A fast train can move railroad car-mounted *Minuteman* missiles at a rate of 75 miles an hour on cleared and undamaged tracks. Nuclear-powered submarines move the *Polaris* more slowly but in a more obscured and limited directional environment.

The *Valkyries* would be about 30 times as mobile as a *Minuteman* while carrying many times the destructive capability. The bomber would also have the added flexibility needed to strike many targets with the proper size of weapon on a single sortie. The B-70 would concentrate on military targets: missile sites, airfields, control centers. After that it could strike targets of opportunity: individual installations that house the enemy's war-making capability, rather than cities and generalized areas.

The speed, range, and flexibility of the B-70 are still needed even though we equip our present B-52 *Stratoforts* with the hypersonic, thousand-mile *Sky Bolts*.

"There are many targets deep in the interior of our potential enemy which are more than 1,000 miles from the enemy defenses," General White said. "That being so, to reach them the bomber must penetrate—even though it has the air-launched missile *(Sky Bolt)* aboard. In addition to that, many of these targets probably require heavier yield than the warhead yield of the air-launched missile and thus require a bomb of greater megaton yield."

The B-52s can use *Hound Dog* missiles to blast their way past enemy defenses in order to strike more vital areas with the primary bomb load. The B-70 *Valkyries* wouldn't need to blast their way in and would thus save their punch for the knockout blow.

SAC's commander, Gen. Thomas S. Power, made a bid before Congress for his bomber crews on these penetration missions: "If men have to go over there against sophisticated enemy defenses, this country owes it to them to give them a modern piece of equipment so that they can survive."

Even the briefest glance at our aircraft procurement and pilot-training figures shows that we are putting more and more of our cold war deterrent eggs in the missile basket. General White thinks that the enemy might not long be deterred by an unknown number of missiles nesting in holes in the ground or in submarines. He likens missiles to a Maginot Line on which we might be tempted to build complacency.

Besides being able to do so many things that a missile cannot, manned aircraft such as the B-70 would be plainly visible proof of our state of readiness. The complexities and capabilities of the airplane would provide a constant challenge to keep crews and support personnel alert. A psychological weapon with a great impact, the airplane's performance and versatility would be there for all to see, our own people, our allies, and the enemy.

The B-70 has still other potentialities. It is a big airplane despite the fact that it will occupy less hangar floor space than the B-52 and will operate from the same runways. Relatively little modification, such as replacing tons of electronic equipment with seats, would be needed to make it into a Mach 3 transport able to airlift 60 people to any spot on the globe in five hours. Such an air vehicle could deliver six of the Army's *Honest John* missiles with their crews anywhere in the world.

The B-70 will cruise at speeds greater than a high velocity rifle bullet. It is practically automatic—it has to be. The bomb/navigation system, one of the most sophisticated of its type, incorporates a star-tracking unit, inertial platform, doppler radar, and a digital computer. It has the refinements of a missile guidance system with the added advantage of human input—a thinking, decision-making crew to monitor, correct, or reprogram it. Even if the four-man crew died or were rendered unconscious enroute to a target, the aircraft could complete its mission without them.

Radar equipment, virtually free of countermeasure jamming, would be completely new and of the most advanced type known. An electronic defensive system, unlike any in use today, would use electromagnetic and other techniques to make it very difficult for enemy aircraft or missiles to attack successfully the B-70.

All this electronic equipment is modular designed, packaged in drawer-like components, and housed in the fuselage just behind the crew's compartment. Thus the entire system can be easily maintained in flight by simply substituting black boxes.

The entire aircraft is designed for easy maintenance. Even the engines "plug in" to the accessory section

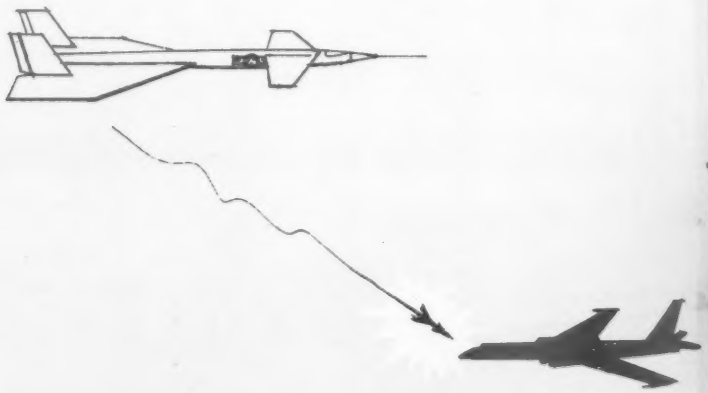
which is built as part of the airframe. Four men with as little as a year and a half of jet-engine experience could change one of the rail-mounted engines in 25 minutes. All of the General Electric J-93 engines will be completely interchangeable so fewer spares will be kept on the shelf.

The basic design features of the B-70 with the crew sitting far ahead of the engines will make it relatively simple for engineers to adapt the airplane for nuclear propulsion plants if and when they are operational.

The B-70 is a tremendous engineering feat and this accounts somewhat for its high cost. Two hundred thousand engineering man-hours went into the B-17 before it went into production in 1937. The B-70 will require 14.5 million engineering man-hours, a seventy-fold increase in the requirements for skilled and trained scientists and engineers. In 1937, aircraft workers earned about 60 cents an hour. Last November the basic average hourly earning in the aircraft industry was $2.66. When you add the costs of inflation and the demanding manufacturing techniques, the price of the B-70 appears much more reasonable.

The manufacturing techniques are as revolutionary as the airplane. North American Aviation, prime contractor for the *Valkyrie,* admits that three years ago the B-70 couldn't have been built because they didn't have the manufacturing know-how. The strength requirements and demands for accuracy and precision were greater than anyone had ever considered before. Even the materials used were so new that no company had any experience working with them outside a laboratory.

More than three-quarters of the airplane's exterior is made of steel honeycomb—a cell-like steel webbing sandwiched between thin sheets of stainless steel and brazed into a slab as strong, but much lighter than, solid steel. Some of these sheets and cells are little more than foil, six-thousandths of an inch thick. So exacting is the brazing process that a single fingerprint on the fragile sheet will prevent it from bonding, so workmen handle it with white cotton gloves. Adding just one-thousandth of an inch to the thickness of this skin would increase the weight of a B-70 by a ton. The



Fitted with air-to-air rockets and the proper radar the* Valkyrie *could become a long-range interceptor to prey on enemy bombers in their own skies.

material cannot be riveted, it must be welded. Some of it must be milled (machined) to tolerances of one-half of one-thousandth of an inch—less than the diameter of a human hair.

But there's no doubt that the airplane can be built now. North American singled out top engineers and workmen to solve 28 separate manufacturing processes. Nearly a year ago the company announced that all manufacturing problems had been licked.

The answers to the manufacturing problems are as fantastic as everything else about the B-70. Now, North American has machines that "grind" metal with a spark discharge method that reverses the electroplating process—each spark that leaves the surface carries with it a microscopic amount of metal. Some machines are automatic, operated by magnetic tapes like those used in sound recorders. Other machines are operated by punchcards. Workmen, taught new skills, monitor their machines much as the B-70 crew will monitor their electronic gear.

An edge-preparation machine shears a sheet of honeycomb steel 16 feet wide and turns up a lip twelve-thousandths of an inch, ready for welding. The welded joint is rolled flush by a machine that can exert 19,000 pounds pressure, then every inch is X-rayed to insure the quality of the joint. Such quality is essential to keep the 200-ton plus airplane, traveling 2,000 m.p.h. and heated up to 550 degrees in the process, from coming apart at the seams. Instead of joining steel tubes with conventional nuts and bolts, they are brazed. The process saves more than a thousand pounds of nuts-and-bolts weight in a single aircraft.

Of course, these are mass production tools and machines that would be useful only to produce many airplanes. The prototype now planned won't use many of the machines because it will be cheaper to hand-make many items and parts. Nor will the prototype have the advanced electronic systems planned for the weapon systems. Most of the subsystem contracts were cancelled last fall when the program was cut back. Like the rest of the airplane, the electronic and other subsystems must be mass-produced in order to lower their tremendous cost. Since the prototype is intended only to prove that the B-70 would be feasible to build and fly, the subsystems produced for this prototype will not be fully tested for other than flight safety and airworthiness.

The prototype B-70 will need a crew of only two instead of the four people required by the weapon system. The encapsulated seats that will permit the crew to eject safely at very high altitudes without oxygen masks or pressure suits will be retained, but minus the survival equipment. The air conditioning and pressurization system that provides a shirt-sleeve cabin environment despite the 500-degree skin temperature of the aircraft will be reduced to half its planned size in the XB-70 prototype. That's because less electronic equipment inside the cabin will be adding its heat to the aircraft's interior. The full-scale air conditioning system would cool quite a large building.

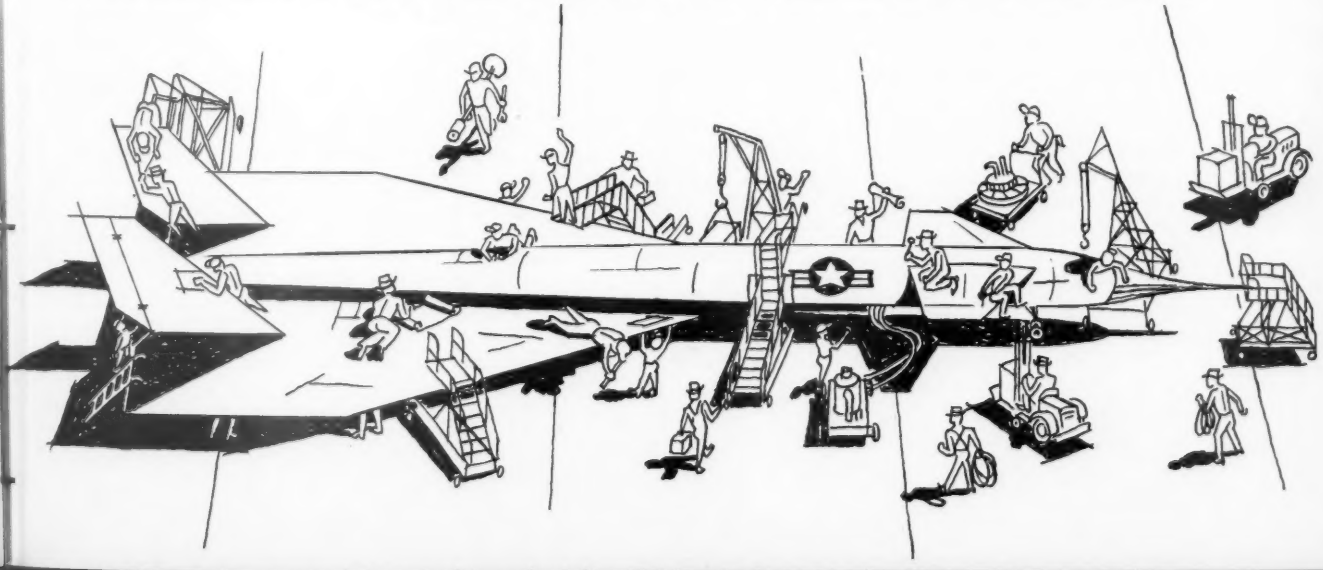
The total effect of the cut back to a prototype before production will delay the weapon system program by about two years, General White told Congress.

Meanwhile, Great Britain has announced plans to build a Mach 3 transport plane. The Soviet Union is said to be planning similar commercial transport aircraft. Of course, with much of the tooling already done by North American and with the technical knowledge at hand, there is no reason why this country cannot go ahead with a commercial version of the *Valkyrie*. It wouldn't be the first time that military aircraft development in this country paved the way for dramatic advances in commercial aviation.

General Nathan F. Twining, Chairman of the Joint Chiefs of Staff, has said that the balanced military forces of the United States must accomplish four objectives: *deter general war, deter limited war, win a general war if one is forced on us, and win a limited war if we become involved.*

The B-70 *Valkyrie* is a tool designed to play an important part in attaining all four objectives. The Air Force thinks it is the best tool available.

In production, 20,000 firms all over the U. S. would supply 8,000 subcontractors to build a space-weapon wing.



Your Personal Flight Plan

It's filed, but the ETA depends on your wheels up time.

DURING 1959, approximately 160,000 airmen ignored a gold-barred silver-winged job offer paying more than $5,000 annually and featuring almost guaranteed opportunities for education, promotion, and worldwide travel.

The odds are about 4.5 to 1 that you're one of these airmen, and frankly, if you delight in confusing members of the Air Staff, be assured you have. Furthermore, their perplexity is compounded by the fact that airmen aren't the only ones turning thumbs down on this standing offer. Although the salary is a less significant factor in their case, only 243 out of last year's 3,577 eligible ROTC graduates chose to apply. By this you could easily jump to the conclusion there must be something wrong with the job. But there isn't.

The position? Commissioned officer and rated navigator in the United States Air Force. Work to be done? Provide direction and potency to the movement of manned, aerospace weapon systems, transforming them from vehicles of transportation to deadly instruments of global war.

There is nothing routine about this task. In one case the job includes jamming enemy radar. In another, it means directing a fast-moving interceptor into the proper rocket-launch position. In still another it means releasing a nuclear weapon. And in the very near future it will require the accurate launch of airborne ballistic missiles from distances no longer calculated in feet up, but miles out.

Obviously, the skills to accomplish these admittedly formidable tasks must be acquired through an effective training program. Equally obvious is the fact that today's and tomorrow's navigators come close to negating the old theory that there is no such thing as an indispensable man. Well, singularly speaking, it may be true, but adventurous all-American type youths could hardly find a more interesting, challenging and important job in a day and age when the last frontiers are celestial. Then why the dearth of applicants?

Perhaps a Misconception?

That's the question Hq USAF would like answered. There are several reasons. "One," a DCS/Personnel official points out, "may be an individual's reluctance to embark on a journey into the unknown when he is successfully employed in a reasonably secure position." Fear of failure may be a factor here, but as this article reveals later, attrition records indicate such fear gen-

by Capt. Ted R. Sturm (Ret.)

erally to be unfounded. Another reason may be a hesitancy to invest one's future in what is believed to be a diminishing career field. With the increasing number of missile squadrons demanding more and more missileers, a misconception that the role of manned aircraft—and navigators—is on the downswing may be prevalent. Or finally many airmen may simply be uninformed about the program and their eligibility to apply.

In the latter case, a recent drive to encourage airmen applicants resulted numbers-wise in a satisfactory burst of applications, but it dwindled soon after the drive subsided. As far as a reduced requirement for aircraft goes, top Air Staff members hasten to point out that the need for navigators is a long way from any erroneously conceived decline.

Although missiles will eventually comprise the lion's share of aerospace forces, manned aircraft will remain in the inventory indefinitely. As General White has repeatedly emphasized, the foreseeable future indicates a growing need for a balanced, mixed force of missiles and manned aircraft. In addition, navigation training provides a background readily adaptable to the duties of an ICBM guidance officer.

Beyond that "foreseeable future" lie manned space flight and the beginning of a navigational requirement quantitatively and qualitatively surpassing anything in the past. Yet surprisingly enough, the eligibility requirements for application can be stated in one sentence: You are qualified to apply for Aviation Cadet Navigator Training if you are 19 to 26½ years of age, single, and a graduate of an accredited high school.

Hoover's Story

In 1951, Dick Hoover was an airman second working in the electronics career field at Kirtland AFB, N. Mex. He liked the Air Force, the base, and his work, but figured if he was going to make a career of it, he wanted a commission. A tour in Korea interrupted a planned application for officer training, but in late 1954 as he neared the end of his first hitch, Hoover, by then a staff sergeant, applied for aviation cadets. With his background in electronics, he was primarily interested in becoming a navigator. He was selected.

"I had no illusions about breezing through the training," he recalls, "but when I glanced at the outline of subjects that first day, I turned pale."

He talks about the course that led to his wings and bars as though it happened to somebody else, and per-

Two instructors undergo refresher training on the astrocompass at James Connally AFB, Tex. They are part of the instructor corps enabling Air Training Command to turn out more than 1500 graduate navigators a year.

haps it's more accurate that way. Dick Hoover comments slyly that he hasn't been the same since.

"Seriously, though," he said slowly, "my decision to become a navigator was one of the most important in my life. Not just because I'm making more money and have a higher grade, but because it opens a door to a highly promising future. The training was top-notch."

Today, 1st Lt. Richard Hoover navigates a C-123 out of the 776th Troop Carrier Squadron, Pope AFB, N. C., to any part of the world that gets mentioned in his operations orders.

It is apparent that everyone eligible to apply for the training isn't going to make the grade. There are some pitfalls on the road to success. Physical qualifications, written examinations, and the course of training itself—which unerringly separates the soft-touch hunters from the level heads who realize nobody's giving away anything these days—all take a toll of the hopefuls.

It is conceded that the course is a tough academic grind. Yet men who once thought they had no aptitude for technical subjects continue to amaze themselves by establishing commendable records. If an individual has a good high school math course behind him, it makes things easier. But students with no prior instruction in any of the sciences have successfully learned from the ground up. The training is designed that way.

Generally, if a man's not afraid of work and study, he'll make it. Attrition rates show that less than 15 percent of those who begin training fall by the wayside because they can't cut the academic subjects or flying missions.

If there is any difference in the course Lieutenant Hoover took and the one facing potential navigators today, it would be primarily a matter of additional subjects added to keep pace with the supersonic advance of technology. One thing has not changed: A glance at the curriculum still makes newcomers turn pale and wince.

It's a natural, initial reaction, because today's training is geared to produce men not only qualified to direct an aircraft from point A to point B, but to give them a solid background in electronics and other related fields. This facilitates gradual and eventual upgrading in the more advanced phases of the art as the navigator gains experience in the field. Lieutenant Hoover, for example, proceeded directly from the primary-basic course to an operational unit. He's not now concerned with missile firings and space navigation, but at some future date he may well return to school in an advanced course.

On the other hand, some graduates enter advanced schools as soon as they finish the primary-basic course.

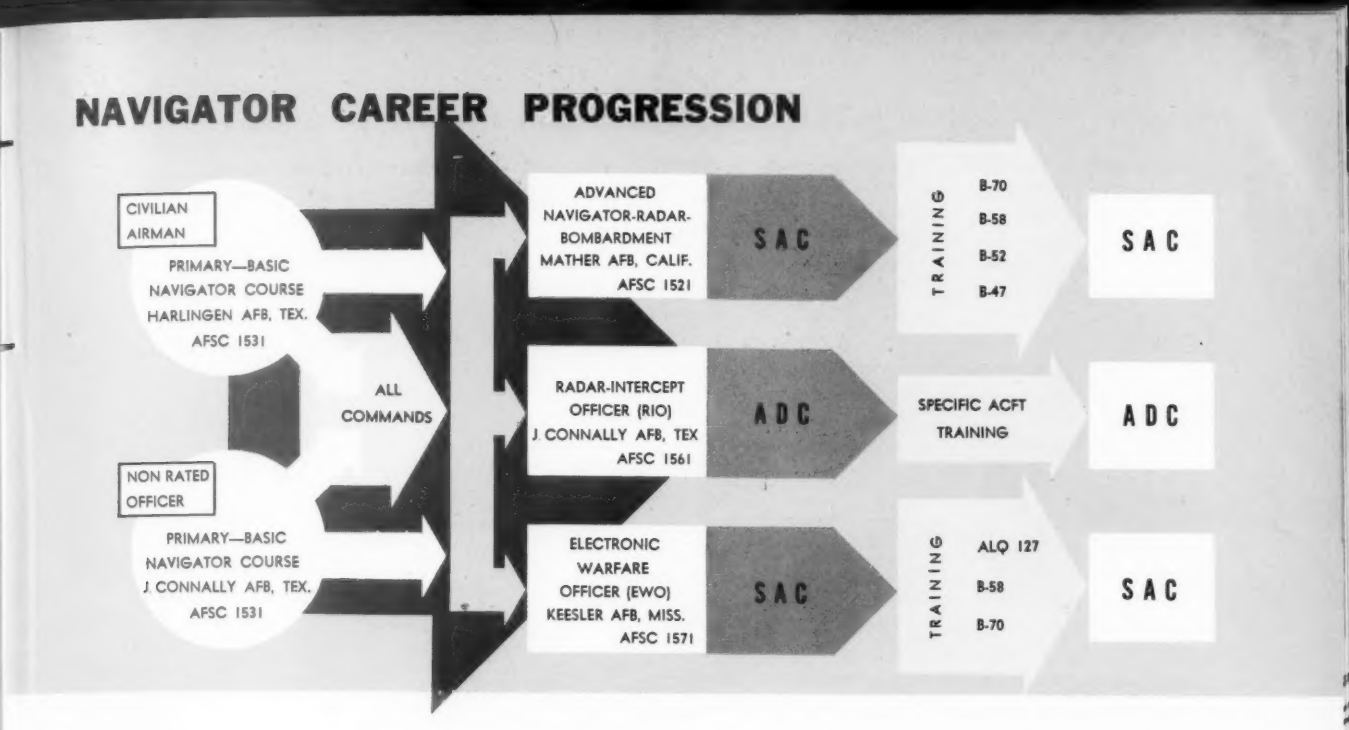
It is expected that about 66 percent of the people entering the new, revitalized program which begins in August will be in the aviation cadet category. That is, students direct from civilian life and entries from among airmen on active duty. These aviation cadets will get their primary-basic training at Air Training Command's Harlingen AFB, Tex.

Student officers from OTS/OCS, ROTC, and other nonrated officers on active duty comprise the balance of the navigator trainees. They receive the same course of training at James Connally AFB, in Waco, Texas, also an ATC base. In fact, all the formal navigational training from primary-basic through the advanced courses is conducted by ATC. Both Harlingen and James Connally AFBs conduct identical academic and flying training, differing only in the amount of military training afforded the students. This fact, and the number of people in the program, are the main reasons why there are two primary-basic schools. Students officers are of course not required to take as many military subjects nor undergo as much military training as cadets.

The student officers' course runs 175 training days which works out roughly to nine months. Cadet training takes 15 additional days. During this time trainees pile up 160 hours' flying time in the T-29, USAF's navigation training aircraft. Naturally, the flight missions tie closely with subjects covered in 555 classroom hours. What is taught?

Dead reckoning, weather, equipment, maps, charts, celestial (sunlines), night celestial, grid, loran, pressure differential, radar, nuclear weapons, etc. But if you think this looks formidable, wait until you get briefed on the contents of the advanced courses. They may frighten you now, but by the time you finish primary-basic you will get, along with your wings and commission, a second stage boost of self-confidence which should provide enough thrust to accelerate you to a successful escape velocity.

Your navigator wings proclaim your ability to ac-



complish part of the work, i.e., provide direction to aircraft. If you go direct to operational units instead of advanced training, you can be sure the duty will be in transport or tanker type aircraft.

But if a primary-basic graduate is selected to go to advance training, there are three courses open. One is located at Math AFB, Calif. where training is geared to produce navigators for the SAC. The course is called the advanced Navigator-Radar Bombardment course and it is not quite as long as primary-basic—135 training days. It is heavy on electronics, taking students from basic electricity through a comprehension of radar circuitry. Classes are comprised of navigators in for upgrading from operational units and recent graduates of primary-basic. Again, the T-29 is the training aircraft, and students log roughly 90 flying hours practicing radar and grid navigation and bombing with the "K" bombing-navigation system.

When they finish the training, they are ready to join SAC for assignment to B-47s, B-52s, B-58s and eventually, it is hoped, the B-70. Some graduates of this course are also assigned to TAC and ADC. What the flight crews of SAC do should be pretty well known by now.

Electronic warfare training is the second advanced course, and it too, leads to SAC. This course is conducted at Keesler AFB, Miss., the Electronics Center of the Air Force. EW lives up to the title of its parent base, and makes the electronics given at Mather look like a primer. Electronic Warfare *is* electronics—all 170 training days of it. Students put in 135 hours in the air, using C-54s and T-29s. When they graduate they are assigned to SAC with future duty in the B-52, B-58 and possibly the B-70.

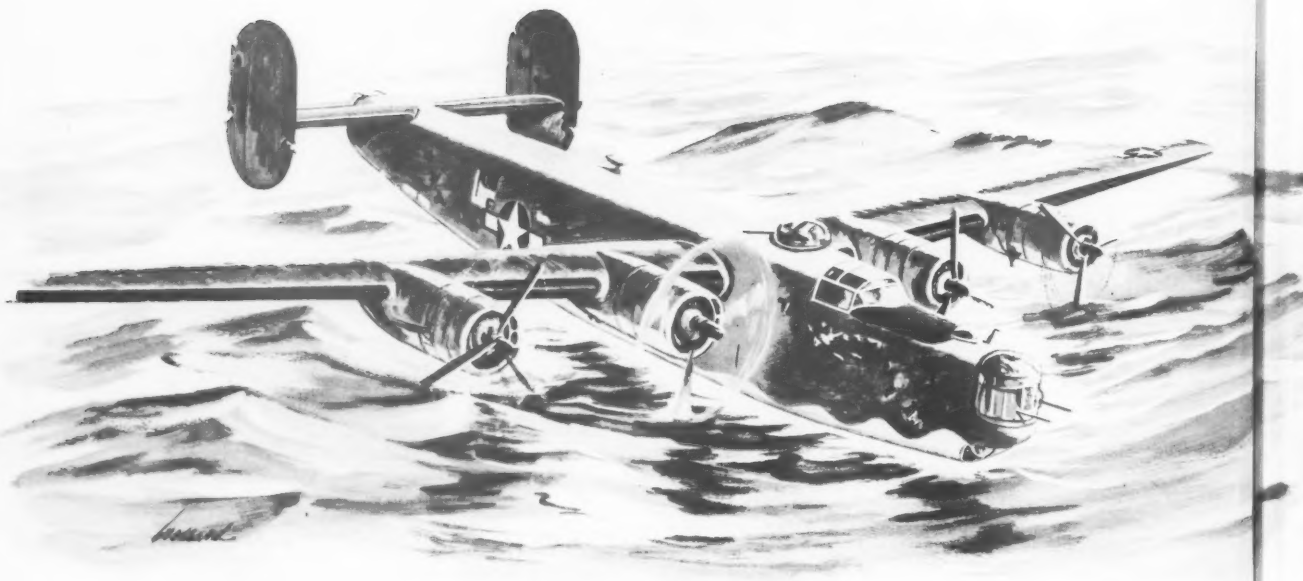
There is another advanced school for the navigator and it is located at James Connally AFB, site of the student officers primary-basic course. This school trains radar-intercept officers for duty in the two-place, all-weather fighter interceptors of the Air Defense Command. The course is 125 days long and provides 33 hours in F-89Js and 575 academic hours which are also heavy on electronics. Additionally, students put in about 50 hours in flight simulators and 30 hours in the T-29. The job in ADC calls for the ability to operate radar-intercept equipment from the back seat of aircraft like the F-101B, directing the pilot of the jet into proper position for launching rockets at enemy aircraft.

By now, the statement made earlier about nothing being wrong with the job should be justified. As Lieutenant Hoover said, the decision to apply could be the most important one in a man's life—particularly in an era when electronics is fast becoming the predominant element in almost all walks of life. From "cockpit" duty, navigators can move to command and staff positions, into advanced schools of the Air Force, and numerous other pathways to the fulfillment of a successful career.

In the accompanying chart, you can see the entire navigator career progression laid out from start to finish. Not really the finish either, because although you should be firmly established in your new career by the time you work your way to one of the boxes on the extreme right, there will probably be a few more added. What happens after that depends on you.

Months of pre-invasion bombing had followed the set pattern of reducing Germany's continental defenses to rubble. Now, the final phase called for a

Feint at Pas



by SMSgt. Hal Bamford

THERE was little in the military career of the former Infantry officer, 29-year-old Lt. Col. Leon R. Vance, Jr., to indicate that he was destined to win his Nation's highest award for bravery.

Despite the fact that he was an excellent officer and flyer, had risen quite rapidly in rank, and was respected and admired by those around him, only fateful events of circumstance placed him in the position which led to his heroic action of June 5, 1944.

Many months of the Allied heavy-bombardment campaign had softened Europe for the eventual invasion of the Continent, but it was the final, more specific phases which provided the setting for Colonel Vance's action.

As the key day approached, an overall air-plan in support of *Operation Overlord* was published which divided the remaining pre-invasion days into three distinct phases.

Phase One extended from D-Day minus 50 through D-Day minus 30. The stress was to be placed on counter-air force operations and on reconnaissance.

Phase Two was designated as the preparatory phase, running from D-Day minus 30 to D-Day minus one. In order of importance, the targets selected were the German Air Force, strategic railway centers, selected coastal batteries, and airfields within a radius of 130 miles of Caen, France.

The third and final period was the assault phase, scheduled to begin the night before the invasion and to include a paratroop drop behind the German lines of defense.

The climax of Phase Two called for 50 percent of all 8th Air Force bombers to remain on the ground thus providing a reservoir of rested crews to support the actual invasion. Half of the remaining force would strike seven selected targets in Normandy. The others would hit an equal number of targets in the Pas de Calais area. On June 4, the raids were executed with better than average results.

It was at this point, however, that fate dealt herself a hand in this grim game. Later in the day, weather forced postponement of the invasion until June 6, and it became necessary to repeat the climactic aerial operation of June 4 on the following day.

The apparently unnecessary concentration in the Pas de Calais area was a part of the overall plan to

de Calais

In the Name of Congress

No. 21 IN A SERIES

keep the Germans off-balance and guessing at the exact invasion area.

Colonel Vance was selected to lead the June 5 formation of B-24s which would strike at Wimereaux, one of the seven designated targets in this sector.

His group was airborne on schedule and headed into the assigned target, a comparatively short strike for the far-ranging heavies.

The citation awarding the colonel his Medal of Honor, the 30th presented to an Air Force man and the 25th of World War II, was published on January 4, 1945, and gives an accurate description of his heroic action following the crippling of his aircraft.

For conspicuous gallantry and intrepidity above and beyond the call of duty on 5 June 1944, when he led a heavy bombardment group, in an attack against defended enemy coastal positions in the vicinity of Wimereaux, France. Approaching the target, his aircraft was hit repeatedly by antiaircartf fire which seriously crippled the ship, killed the pilot, and wounded several members of the crew, including Lieutenant Colonel Vance, whose right foot was practically severed. In spite of his injury, and with three engines lost to flak, he led his formation over the target, bombing it successfully. After applying a tourniquet to his leg, with the aid of the radio operator, Lieutenant Colonel Vance, realizing that the ship was approaching a stall attitude with the one remaining engine failing, struggled to a semi-upright position beside the copilot and took over control of the ship. Cutting the power and feathering the last engine he put the aircraft in a glide sufficiently steep to maintain his airspeed. Gradually losing altitude, he at last reached the English coast, whereupon he ordered all members of the crew to bail out as he knew they would all safely make land. But he received a message over the interphone system which led him to believe one of the crew members was unable to jump due to injuries; so he made the decision to ditch the ship in the Channel, thereby giving this man a chance for life. To add further to the danger of ditching the ship in his crippled condition, there was a 500-pound bomb hung up in the bomb bay. Unable to climb into the seat vacated by the copilot, since his foot, hanging on to his leg by a few tendons, had become lodged behind the copilot's seat, he nevertheless made a successful ditching while lying on the floor using only aileron and elevators for control and the side window of the cockpit for visual reference. On coming to rest in the water the aircraft commenced to sink rapidly with Lieutenant Colonel Vance pinned in the cockpit by the upper turret which had crashed in during the landing. As it was settling beneath the waves an explosion occurred which threw Lieutenant Colonel Vance clear of the wreckage. After clinging to a piece of floating wreckage until he could muster sufficient strength to inflate his life vest he began a search for the crew member he believed to be aboard. Failing to find anyone he began swimming and was found approximately 50 minutes later by an Air-Sea Rescue craft. By his extraordinary flying skill and gallant leadership, despite his grave injury, Lieutenant Colonel Vance led his formation to a successful bombing of the assigned target and returned the crew to a point where they could bail out with safety. His gallant and valorous decision to ditch the aircraft in order to give the crew member he believed to be aboard a chance for life exemplifies the highest traditions of the Armed Forces of the United States.

After the colonel had been rescued from the Channel, he was immediately rushed to a nearby hospital. Despite the fact he had lost his foot, he was soon well on the road to recovery.

Consequently, on the morning of July 26, he boarded a hospital plane and departed England for the U. S.

But fate had not finished with Lt. Col. Leon R. Vance, Jr. Somewhere between England and the first scheduled stop at Iceland, the aircraft crashed, carrying all the passengers and crewmen to their deaths.

Today, Vance AFB near Enid, Okla., its namesake's birthplace, stands as a lasting tribute to another of this Nation's dedicated airmen; a man who risked his life in the belief he was assisting another, then died as an indirect result of that heroic action.

You should know

Ounce of Prevention

The pound of cure in your medicine cabinet may need some first aid of its own if its like many. It's not safe to hoard medicine the family no longer uses.

If you must keep poisons and dangerous drugs, keep them in a cabinet or storage apart from the after shave lotion and toothpaste. They're killers. According to O. L. Hoggsett, University of Illinois safety specialist, four-fifths of all fatal poisoning accidents occur in the home. About one-third of the victims are children under four.

If children can reach the cabinet holding your potent medicines, fasten and lock it.

Under the Skin

When you read or talk about the *Atlas* missile remember it's not a big heavy piece of metal shot into space with powerful thrust. This intricate, stainless steel "bird" weighs more than 250,000 pounds when launched, yet its skin is but from one to four hundredths of an inch thick.

Standing erect the missile is as tall as a seven-story building but it would warp and possibly collapse if the inside was not under constant pressurization or in "stretch." The skin must be kept at drumhead tautness at all times, even when erect on the launch pad.

Summer Sorrow

With summer comes the Nation's second worst grim reaper. Water sports, boating, swimming, and skiing can be a real pleasure but to avoid injury or an obituary in the accidental death column, observe these basic rules of water safety.

Never swim alone, in restricted areas, while tired, or right after eating. Always know and stay within the limits of your swimming ability. Stay away from fast currents and undertows. Check water for depth and obstructions. Keep a sharp lookout for small children in your swimming area and avoid "ducking" and horse play. If you don't swim and want to wade, be sure to wear protective foot covering.

To enjoy boating comply first with all federal, state, and local regulations. Then remember to keep away from congested areas and the wake of larger boats, carry extra fuel with you, never refuel with your motor running, and if you capsize, stay with the boat. Stay ashore in bad or threatening weather.

For those who don't go near the water, avoid over exposure and use approved lotions, oils, or creams until you have a protective tan.

Safe water skiing requires use of five basic rules: be a good swimmer, know the signals, ski only in clear authorized areas, wear a life belt, and never put any part of the body through the tow bridle.

Curiosity Does Kill

It's a natural trait, explain officials of the 2700th Explosive Ordnance Disposal Group at Hill AFB, Utah, but people are always curious about explosives, especially younger people.

Files of the group are crowded with reports of children who have found or been given hand grenades, blasting caps, "empty" shells and similar ordnance. In one case, adult fishermen "caught" 14 aircraft rockets in their nets and gave them to a group of children.

During a nine-month period last year the group was called in on 358 such hazardous incidents.

In another two civilians found a ballistic-shaped weapon on a bombing and gunnery range, took it home to examine, and upon attempting to dismantle it, lost their lives in the ensuing explosion.

Even seemingly harmless Fourth of July fireworks next month should be handled with extreme caution. They too can be dangerous.

If in doubt, don't touch it . . . report it.

Take Cover

In the event of an atomic explosion, you can take certain personal safety steps. There are atomic injuries from heat, radiation, and blast. Flying debris, falling buildings, and other blast results take by far the highest toll. You can minimize your chances of injury by falling down into a doorway or against a wall if you hear a blast.

To escape flash damage the exposed skin on your body must be covered within one second after seeing the bright light.

Fallout from the mushroom cloud

will not reach earth until a few minutes after debris has stopped falling. You should seek underground or good cover quickly and remain until an all-clear signal is sounded.

. . . In Writing

Those who purchased homes through the FHA, using DD Form 802 to secure Servicemen's Mortgage Insurance, are reminded that AFR 34-65 requires an individual to notify his commander, in writing, immediately upon termination of ownership of the property covered by the loan.

Ponder Promotions

Promotions are not awarded to airmen merely because their past duty performance is good. Promotions must go to those who have indicated by their acts that they will perform effectively in the next higher grade. AFR 39-29 states that promotions will be given to the "best qualified" of all eligible airmen.

Waive the Waiver

If you still retain NSLI insurance under waiver of premiums (free insurance), you should know the handicap this can cause your dependents.

For example a master sergeant with 13 years' service was recently killed in an aircraft crash. With a wife and one child he had assessed his survivors' benefit program thusly: $10,000 NSLI insurance (under waiver of premiums), $10,000 commercial insurance, and $148 per month from the survivors' benefits program. He had what he thought was adequate protection. But his commercial insurance had an aviation exclusion "rider" in it and paid nothing. *Since his GI insurance was under waiver his survivors were not eligible for the new survivors' benefit payments.* Instead they receive $97 per month until the child reaches 18 at which time payments will drop to $70 monthly.

—MSGT. PAUL J. TURNER

he was or if he returned safely to his home base. The 1st Bombardment Division (Heavy) received a Presidential Unit Citation for this mission. And I would like to say thanks to Col. James H. Howard as I feel he was the paramount factor in a successful mission and directly contributed to our old *Flying Fort*, "Yankee Rebels," getting home safe though full of holes.

TSgt. Bartholomew R. Hagan
Stewart AFB, N. Y.

★ ★ ★

. . . AND AN APOLOGY

Sir: I would like to express my thanks for the excellent job you did on the story of the award of my Medal of Honor. However, there is one error I should like to correct. You noted that I succeeded to the command of my group after my "predecessor was killed in a mid-air collision with an enemy fighter." This is incorrect. Col. Kenneth Martin was involved in such a collision; however, although assumed dead at the time, he managed to survive and spent the balance of the war in a German prison camp. Today, he lives in Kansas City, Mo., after receiving a disability retirement sometime around 1950.

Brig. Gen. James H. Howard
Washington, D. C.

★ ★ ★

IDENTIFICATION WANTED

Sir: I read with a great deal of interest Sergeant Craven's article on Major Schroeder in the March issue of THE AIRMAN. My father (see cut), the late Lt. William P. B. Bell, was stationed at McCook about the same time. Can any of your readers identify the pilot who appears at the right in the enclosed photo?

TSgt. William P. Bell
Alexandria, Va.

RETRAINING

Sir: Where can I find a listing of the AFSCs from which men are eligible to apply for retraining?

SSgt. Delmar Milligan
APO 321, New York, N. Y.

• *Both AFRs 39-8 and 39-9 contain resource skill lists for OJT and for formal retraining.*

★ ★ ★

MORE 300s

Sir: In answer to Sergeant Segatti's query in a recent *Letters to the Editor* column, in August 1949, a C-82, based at Sewart AFB, Tenn., logged 522 hours in a one-month period.

Maj. William E. Lennon
Sewart AFB, Tenn.

Sir: One of our 1st Weather Wing WB-29s logged 366:20 hours in a 28-day period during 1954.

Maj. Robert L. Moeller
APO 915, San Francisco, Calif.

Sir: At Station 16, Karachi, India, we had several C-47s that flew 300 or more hours per month during WW II.

Maj. Donald W. Becker
Wheeler AFB, Hawaii

Sir: In August 1952, an F-80 of the 41st Fighter Wing in Japan logged over 300 hours.

Capt. Willis D. Muir
Fargo, N. D.

• *From the many letters received, the 522 hours mentioned in Major Lennon's letter topped all others for total time.*

Goodwill wings its way around the world when USAF acts as brother to

OUR

INTERNATIONAL friendship and understanding will soon receive a "shot in the arm" as the Air Force steps up its participation in President Eisenhower's People-to-People program.

Long before the official People-to-People effort got underway in 1956, airmen on overseas assignments characteristically fostered better community relations between Americans and their overseas hosts through the universal language of kindness and understanding. Hundreds of daily acts by individuals, units, and bases still transcend political affiliations as airmen continue in their traditional role as Ambassadors in Blue. (See, *The Friendly Airman,* April, '60, THE AIRMAN)

Yet today there is a new important addition to the People-to-People program. Augmenting local community relations type gestures of overseas personnel, the Air Force now emphasizes cooperation in the "Sister Cities" program.

Town Affiliations

This method of People-to-People contact is private rather than governmental in character. In practice, a community in the United States "pairs off" with a city of comparable size in some foreign country.

Initial contact of the two cities is generally made between the mayors of each. Town Affiliations, a unit of the American Municipal Association which represents some 13,000 U. S. communities, is available for help and guidance in welding the two communities together. Once tied, the cities exchange ideas and projects at three levels: the municipal government; educational, cultural, social, technical, business, professional, civic, religious, labor, youth, hobby, and similar organizations; and on a person-to-person basis.

Already nearly 100 American cities have found a sister abroad. Twenty-three countries are represented by these affiliated communities. These direct community ties have a profound influence on world peace and American foreign relations since they: make friends, help demonstrate the American way of life on a frank person-to-person basis and thus combat the distortions of communist propaganda, and strengthen international friendship. They also make Americans familiar with the culture, society, and people of the other city.

Wings of Mercy

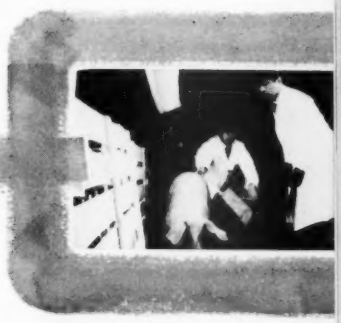
Although Sister City projects are civil in nature, the Air Force has been called upon many times in the past to lend a helping hand to mercy missions and similar projects arising from town affiliations. Once such affiliations are made money is an important factor to the success of exchange projects since no government support is given. Most communities, here and abroad, conduct fund-raising campaigns to carry on their activities. Transportation is a large item in the budget of any town affiliation committee. In cases of emergency time is also a pressing factor.

Last fall when the area of Nagoya, Japan, was struck with a devastating typhoon, her sister, Los Angeles, Calif., was moved with sympathy. Thousands of pounds of relief materials were collected in the California city and the Air Force was asked to rush the mercy cargo to Japan. An Air Force plane, en route to the area, carried the needed supplies.

In January of this year the state of Iowa sent 35 purebred Iowa hogs to its sister state Yamanashi, Japan, also struck by the paralyzing storm. A USAF C-130, specially modified by Lockheed Aviation Company, carried the livestock 6,500 miles and deposited it safely at Tokyo International Airport. The U. S. De-

SISTER CITIES

by MSgt. Paul J. Turner, *Airman Staff*



partment of Agriculture has donated 60,000 bushels of surplus corn to feed hogs and their forthcoming litters for the next two years.

Last October when a TAC unit at Cannon AF Base, N. Mex., was scheduled for a four-month tour in Turkey, Clovis, N. Mex., school children who were studying Turkey in municipal schools conceived an idea to start a friendship with Turkish students. The commander of the tactical fighter squadron agreed to airlift cultural exchange packages to Turkey for the students following an agreement with Adana, Turkey officials. The ensuing exchange of cultural packages and letters has led to the upcoming affiliation of Clovis with the city of Adana in a broadened Sister City program.

One Step Further

In a recent letter to all major air commands with units overseas, Brig. Gen. E. B. LeBailly, Deputy Director of Information, Hq., USAF, outlined a new program to step up Air Force assistance to the Sister City program. In the initial letter overseas units were asked to suggest a sister for the city of Dover, Del. Within weeks over 30 replies were received. Additional American cities will be recommended to overseas units with descriptions of the American towns so that airmen overseas can suggest a good possible "match." Through a concentrated program to help sow Sister City seeds, the Air Force hopes to help "match" several hundred additional cities to assist in attainment of our National goal of three thousand affiliated towns.

How can the Air Force be of special help to the civil program? Primarily because airmen at overseas locations provide a permanent contact between local community officials and similar representatives of American cities. A direct result of such liaison is the affiliation of San Bernardino, Calif., and Tachikawa City, Japan. Both cities are near AMC depots and communications between the information officers of the two bases were instrumental in establishing the civic pairing of the communities. Airmen's efforts also led to the affiliation of Orlando, Fla., and Reykavik, Iceland as well as Dallas, Tex., and Kadena, Okinawa.

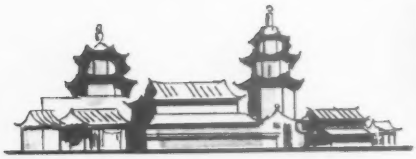
The Individual Role

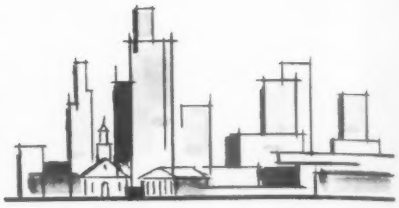
As individuals, airmen can do much to foster the program. The hoglift to Yamanashi, Japan resulted from an idea of an Air Force sergeant who had been stationed in Japan and recognized the potential value of such a relief mission.

Individuals, units, and bases, either overseas or in the ZI can plant the seeds of a Sister City affiliation. Initial contacts should be made with officials of the local community. Favorable responses from them should be referred to base information offices for follow-on action or referral to the American Municipal Association, 1612 "K" Street, NW, Washington 6, D. C. In addition to assistance and advice, AMA's Town Affiliation office also serves as a clearing house, maintaining lists of cities, both in the United States and overseas, that desire affiliation. Upon request it provides a free "how-to-do-it" kit on organizing a Sister City tie.

But . . .

A stated interest in Sister Cities projects indicates USAF's desire to help develop this worthwhile project but there are some pitfalls that airmen, units, and bases are cautioned to avoid. As stated previously, transportation to bridge global gaps is essential to the People-to-People program and as a result many requests for airlift services to promote these civil projects have been





received. Although the USAF unquestionably supports the principle of the People-to-People program, current directives preclude the use of military airlift in support of the program. As a matter of general policy, therefore, such airlift requests should not be forwarded to Hq USAF for approval.

Individuals, units, or bases are encouraged to take an active part in local civic and relief projects but strict adherence to the airlift policy will avoid embarrassment to the Air Force caused by promised airlift services which cannot be furnished.

Price of Peace

Securing world peace is USAF's sole reason for existence. Airmen accomplish this in one way by maintaining aerospace strength for the deterrence of war. Equally important are the goodwill acts of airmen on overseas tours. The challenge of actively supporting the town affiliation program by planting seeds for continued expansion offers airmen another way to promote world peace.

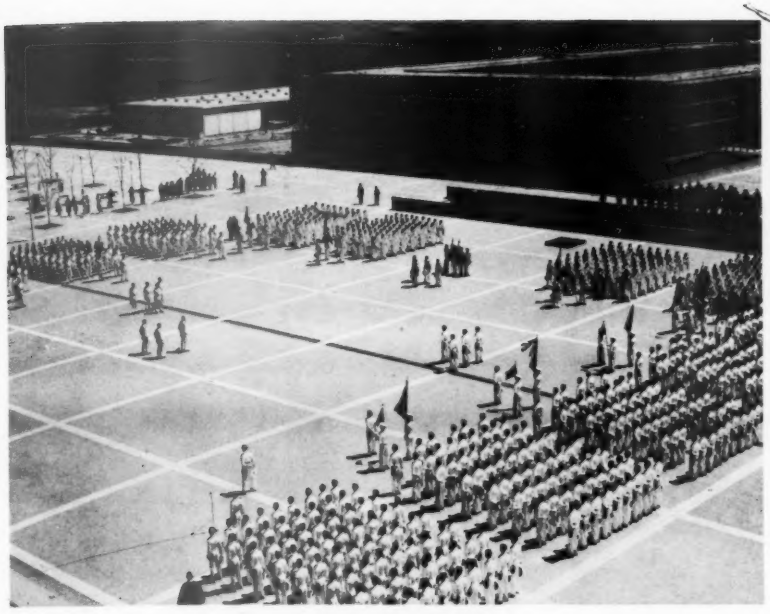
Mr. Richard Oakland, Director of Town Affiliations, has cited the United States Air Force for its active role in promoting Sister City projects. "Active USAF support of the Sister City and other People-to-People themes has been vital to the success of the President's program," he states. "Airmen overseas," he continues, "and in the U. S. can contribute greatly to the human aspects of international understanding by taking the initiative and working actively to help create new town affiliations between hometowns and cities in foreign lands."

A final point brought forth by Mr. Oakland explains that "when overseas, if your hometown has a 'sister,' make it a point to visit the community and let its citizens know of your special interest in their activities."

AVAILABLE

Following is a representative list of some overseas cities desiring an affiliation with an American community. Possibly you can suggest a suitable partner.

Port Elizabeth, Africa
Lincoln, Argentina
Santa Rosa, Argentina
Sydney, Australia
Innsbruck, Austria
Linz, Austria
Oberndorf, Austria
San Joaquin de Flores, Costa Rica
Kaohsiung City, Formosa
Bordeaux, France
Gap, France
Lyons, France
Marseilles, France
Nice, France
Strasbourg, France
Tours, France
Vance, France
Salonika, Greece
Tehran, Iran
Ancona, Italy
Kingston, Jamaica
Atami, Japan
Ito, Japan
Kochi, Japan
Shizuoka, Japan
Takamatsu, Japan
Yokkaichi, Japan
Pusan, Korea
Benghazi, Libya
Penang, Malaya
Armidale, New South Wales
Grafton, New South Wales
Johnsonville, New Zealand
Wellington, New Zealand
Chinandiga, Nicaragua
Corinto, Nicaragua
Granada, Nicaragua
Jinotepe, Nicaragua
Leon, Nicaragua
San Marcos, Nicaragua
Kaduna, Nigeria
Arequipa, Peru
Khartoum, Sudan
Bangkok, Thailand
Edirne, Turkey
Caracas, Venezuela



If a man has a Mach 2 brain, why keep him in a subsonic formation?

***"We won't,"* says the USAF Academy.**

Supersonic Scholars

by 1st Lt. Brian Sheehan, *Airman Staff*

WHEN the registrar at the U. S. Air Force Academy recently received a request for information from a 19-year-old he got the surprise of his life.

The student had already attended Purdue University for two years and had made straight As. On top of that he had been president and valedictorian of his high school class and was an all-state football star.

"That's the kind of student we like," beamed the registrar. "If he enrolls here we'll have some new, souped-up classes for him."

These "souped-up" classes, designed for smart-as-a-whip Cadets and those with prior college training, are part of the new "curriculum enrichment program" which was introduced at the Air Force Academy in the spring semester of 1957.

The program allows some Cadets to learn as much as they can as fast as possible. It gives them a chance to specialize in undergraduate and graduate-level courses and possibly earn a master's degree. Making brain trusts out of our future aerospace leaders is the program's aim.

Cadets entering the sparkling Air Force Academy, built on a 17,800-acre former ranch site in the Rampart Range of the Rocky Mountains, have their hearts set on a bachelor of science degree and a regular Air Force commission. After graduation these young lieutenants want to become jet jockeys, astronauts, space ship pilots, or supersonic navigators.

But before any "fourthclassmen" (freshmen) enter the Academy at Colorado Springs, Colo., they are given a battery of placement tests which reveal their IQs, foreign language ability, math and science know-how, and problem-solving talents.

Prior to coming to the Academy every Cadet has reached a different plateau of learning. This shows up in a hurry in the placement tests. The new prospect from Purdue University applied for admission, was nominated and later accepted. He ranked much higher

CADETS "SIGN IN" *as first step toward four-year academy education. Many may graduate with master's degrees due to school's enrichment program.*

on the exams than students with a single year of "prep" school or those who came directly from high school. But don't forget he had a two-year edge.

The tests showed he had a fourth-year college science ability and a third-year college language ability. His IQ was 138 (among the top 1 percent of all U. S. males) and he was a mathematical whiz. Now the Air Force Academy faculty was faced with a tough decision. Would this student have to repeat classes already taken and successfully passed at a civilian college? "No" was the answer. The remarkable "curriculum enrichment program" stepped in and saved the day for the Cadet. It allows him to take new courses—those he hasn't already studied—and to broaden his interests in science, language, literature, and the arts. In turn this will better prepare him for his future leadership in the Space Age Air Force.

He will have 37 special "enrichment" courses to choose from, and they range from 19th Century American literature to ballistic- and space-vehicle guidance. Among others are thermodynamics, rocket propulsion, political geography, and U. S. diplomatic history. Even a three-hour class called the "Intellectual Foundations of the Western World" is offered.

How will he get approval to take these special classes? By three different methods—validation, acceleration, or overload.

He can validate a class (get credit without taking it) if he passed the equivalent course at another college, made good grades on the College Board Examinations, and high marks on the Academy's validation tests.

The ex-Purdue student had studied two years of German. So at the Academy he'll probably take an-

MODERNLY FURNISHED ROOMS *are conducive to study. Two men from same class share quarters.*

WEEKLY PARADES *keep Cadets on their military toes. Upperclassmen supervise lowerclassmen in military drill, even write effectiveness reports on their subordinates.*

other language—French, Spanish, or Italian—and this will satisfy the school's language requirement and increase his knowledge at the same time.

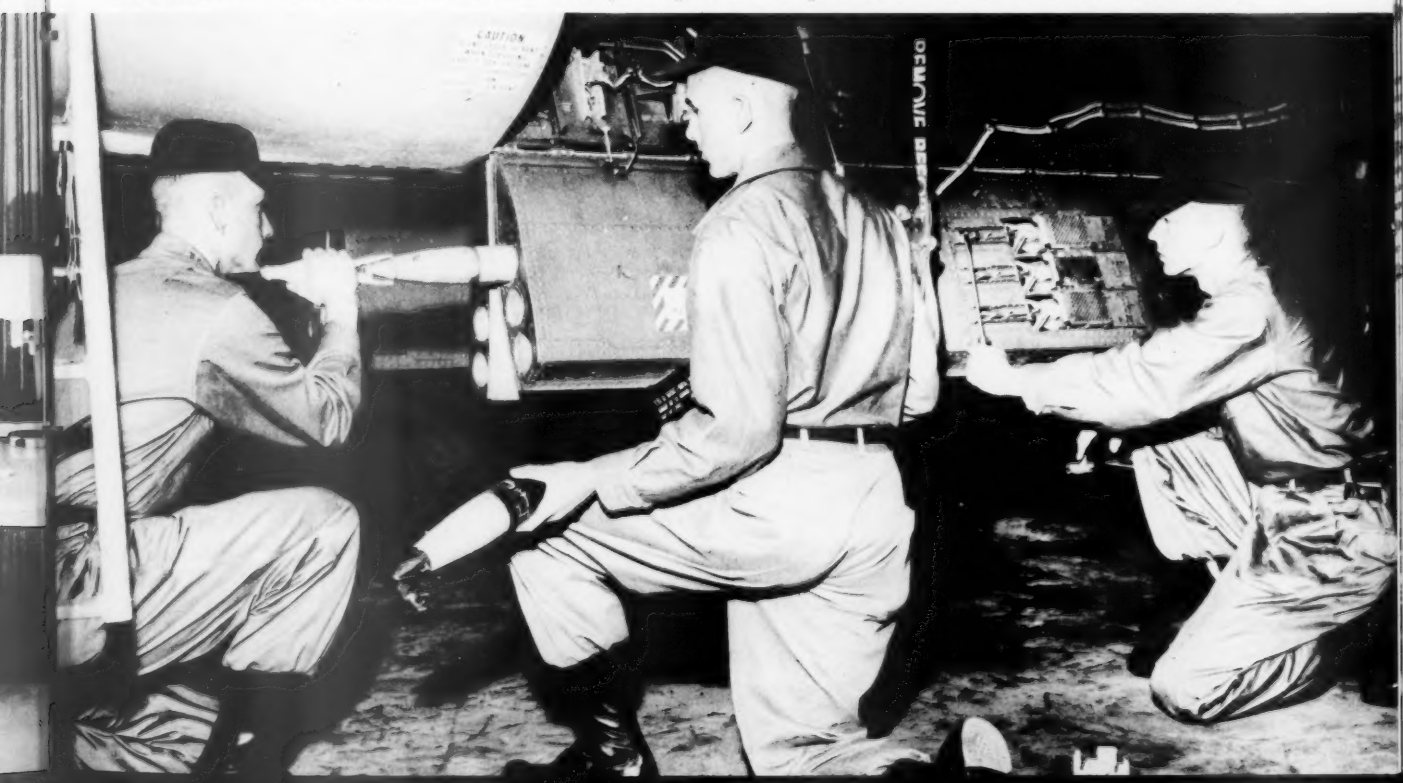
Acceleration is another way he might get the most out of his four year's schooling. Because of his math background he may be able to cram the Air Force Academy's mandatory two-year math course into one year. Then he could select a more difficult mathematics course from the enrichment program.

The final way he might work to his full potential is by overloading on credit hours each semester. If he maintains above average grades in all his prescribed courses he may take an extra class or two above the normal term load (20-21 semester hours).

As an incentive for smart, ambitious students to enter the curriculum enrichment program, a plan has been initiated which lets some Cadets major in a subject. All civilian students graduate from college with a major subject like English, history, physics, or journalism. But this has never been true at our military academies where a Cadet graduated with a straight bachelor of science degree.

Now, however, a major is possible for Cadets. Present Cadets may major in one of four areas: basic sciences, engineering sciences, public affairs, or western culture. Those students with previous college training will find it easier to major in a subject if their credits are transferable. But even Cadets without prior college work can major in a subject. All they have to do is overload on credit hours during their four-year stay at the

AIRMANSHIP STUDIES *take Cadets to bases for experience in operational units. Here Cadets load rockets.*



GOAL OF ALL CADETS *is graduation where they receive regular Air Force commission and bachelor of science degree. Most graduates later attend pilot school.*

Academy. Good grades, of course, are a prerequisite.

Faculty members at the Air Force's "Space School for Supersonic Students" (what some Cadets call their modern school) are developing a program that will permit a few, well-qualified Cadets to graduate with a master's degree.

Beginning with the class of 1963, selected Cadets with "good" credits from other colleges and universities will be able to complete master's degree requirements in either astronautics or public policy. Award of the degrees depends on Congressional authorization and subsequent academic accreditation.

The Academy's enrichment program doesn't make Cadets forsake other aspects of their training and become bookworms and ivory-tower scholars. It is fully compatible with the airmanship and athletic programs. During the 1959 football season, 21 members of the "Falcon" team participated in these classes. They played championship football, made winning grades too.

Likewise, 76 percent of the 46 Cadets chosen by the Commandant of Cadets to hold the ranks of lieutenant colonel and colonel this academic year (1959-60) were enrichment pupils.

Honors already reaped by this program are impressive. When the 1959 class took the graduate records examination, a nationwide test pitting them against graduates from 161 civilian colleges and universities, the results were astonishing. The average Academy graduate—i.e., the man in the middle of his class—surpassed 83 percent of all the students in knowledge of natural sciences. Eighty-two percent of the Cadets outranked their civilian counterparts in social sciences and 69 percent of the new lieutenants were ahead of civilian students in the humanities.

All five Cadets from the first graduating class who were accepted for graduate school had participated in the enrichment program. So had the Academy's first Rhodes Scholar, Lt. Bradley Hosmer, who is now studying political science, philosophy, and economics at Oxford University in England.

Why is there so much stress on this program at the Academy? "The answer is simple," says Brig. Gen. Robert F. McDermott, Dean of the Faculty. "Tomorrow's Air Force will need brainy officers. This is one way we're providing them."

Is That All?

Grade-A astronauts should have a grounding in a few sciences and technical subjects, according to Professor Paul E. Sandorff of the Massachusetts Institute of Technology. Here is what he lists:

Advanced and General Mathematics
Aeronautical Sciences
Astronomy
Automatic Control
Basic Chemistry
Classical Physics
Communications
Electrical Science
Fluid Mechanics and Gas Dynamics
Guidance, Navigation, and Control for Missiles and Spacecraft
Hypersonic and Rarefied Gas Dynamics
Mechanics of Orbits and Trajectories
Metallurgy and Materials
Meterology and Geophysics
Modern and Solid State Physics
Nuclear Technology
Physical Chemistry
Physics of the Upper Atmosphere
Propulsion for Rockets, Missiles, and Space Vehicles
Rocket and Space Vehicle Structure and Materials
Servomechanism Theory and Structure
Solid Mechanics and Physics of Material
Space Medicine
Statics and Dynamics
Thermodynamics
Vehicle Design

Anyone for Art Appreciation?

SLANTS ON SPACE

On June 21 the Sun reaches a position which is its farthest distance north of the equator and appears to stand still in the sky at noon for several days afterward. Expressed another way, the Sun's elevation at midday seems to remain unchanged. When the Sun arrives at this position, it will be the 1960 summer solstice—the latter word derives from a Latin compound, meaning "standing Sun"—and that marks the official beginning of the summer season in the Northern Hemisphere. The solstice date varies with the year, but only by a matter of 24 hours.

The summer solstice brings the longest daylight hours of the year, as much as 15 hours and 19 minutes at many places in the U. S., compared with the 9 hours and 6 minutes of daylight those places will have when the winter solstice arrives this year on December 21.

The count-down would seem to have made its way into the Space Age via the old silent movies. Willy Ley, the historian of missilery's evolution, relates that an acquaintance in this country once remarked to him that the count-down practice had originated with a group of German amateurs who began experimenting with small rockets after WW I. Having been associated with the group, which included Wernher von Braun, Ley knew this wasn't true but the chance remark started him searching his recollections to satisfy his curiosity.

Much to his own surprise, he remembered a German science-fiction motion picture, *The Girl in the Moon,* made by an old friend, Fritz Lang, back in 1929. It had the first count-down Ley encountered.

"This was a silent movie," he recalls, "and at one point the words *10 Seconds To Go* flashed on the screen, followed by the numbers: *6-5-4-3-2-1-FIRE!* Knowing that Fritz Lang had been in the Austrian Army during World War I, I asked him whether he had adapted some military practice which used a count-down. He replied he had thought it up for dramatic purposes when working on the film.

"On a (rocket) proving ground," Ley adds with seeming sarcasm, "nobody would possibly *think* of that side effect."

Illustrations depicting a lunar base with dome shelters of transparent plastic are something less than realistic. The intense ultraviolet light received from the Sun would soon fog and discolor such material, rendering it opaque. Judging by effects at much lower altitudes, other forms of solar radiation, although attenuated to some degree, can have the same effect on materials which admit light; even quartz window shields have had their transparency ruined. On the Moon, too, a transparent dome would be subject to obscuring abrasion by dust particles and micrometeorites. Any long exposure to ultraviolet radiation, of course, would be highly injurious if not fatal to human, animal, or plant life. Any crystal clear, transparent material would provide negligible protection; it would have to be treated to filter out the ultraviolet rays to be of any service.

When the Sun erupts, hurtling vast clouds of gas into space, extremely severe magnetic storms often ensue a day or so later on Earth. Electric currents, generated by the solar disturbance, have been powerful enough on many past occasions to cause fuses on telegraph instruments to blow.

When the line-of-sight distance to Venus is 26 million miles from Earth the minimum propellant energy trajectory for a vehicle would be in the order of 250 million miles. With Mars at 35 million miles, a space vehicle would have to travel about 345 million miles before it reached the surface of the red planet.

Compilation of an accurate photographic map of the Moon's visible face is being undertaken by the French astronomical observatory on Pic du Midi de Bigorre, high in the Pyrenees, and the University of Manchester in England, under USAF sponsorship. The projected map will be on a scale of one to a million and will require some 200,000 pictures to make possible precise calculation of distances and the size of physical features.

Since the invention of the telescope three and a half centuries ago, the surface of the Moon has been charted, and in more recent times, photographed often but the efforts of astronomers in this regard have not been satisfactorily systematic. Existing standards of lunar measurements are based on some 300 mountain peaks and hills, whereas research at Pic du Midi and by the University of Manchester has established that craterlets, or small craters, make better points of reference for that purpose.

The large number of pictures to be made is explained by the fact that each feature must be photographed several times with the Sun in different positions so that sharp images of details can be obtained and shadows measured. Depending on the incident angle of sunlight, the appearance of the lunar landscape changes, particularly in the rugged regions, very much as is the case on Earth. Thus far, some 12,000 frames of film have been taken.

The completed map is expected to make possible the measurement of lunar distances and heights with a precision of close to 26 feet.

—WILLIAM A. KINNEY

Dance of the Heavies

by TSgt. John K. O'Doherty, *Airman Staff*

A TEAM of airmen flying C-130 *Hercules* aircraft out of Sewart AFB, Tenn., is offering spectacular proof that high-speed precision flying is no longer the exclusive province of supersonic fighter types. Dubbed the Four Horsemen after Knute Rockne's famed quartet of precision football players at Notre Dame, the group is the world's only four-engine precision flying team, and has presented its galvanizing program of aerial demonstrations at locations ranging all the way from Denmark to Japan.

The team was formed originally at Ardmore AFB, Okla., in 1957 when four pilots conceived the idea after a routine TDY trip to drop Army paratroopers at Fort Campbell, Ky.

"Have you ever noticed," someone remarked, "that spectators at a troop drop keep their eyes fixed on the parachutes? Nobody notices the aircraft, and precision flying by the troop carrier planes is probably the most important single factor in a successful troop drop."

So the four began to practice—modest variations in routine formations at first—and eventually developed a repertoire of spectacular aerial maneuvers that has thrilled thousands of spectators at airshows in the United States and overseas. These maneuvers—performed in aircraft weighing in the neighborhood of 50 tons—include maximum performance takeoff and climb-out, high-speed diamond formation flyby, the arrow, phasing into the arrowhead, bomb burst, regrouping, and fan break. All these maneuvers are flown with the fluid grace of a ballet presentation at speeds approaching 350 miles per hour. In some cases the wings are interlocked to a depth of six feet, and clearance in other formations will vary from 6 to 15 feet.

There are a number of unique features about the Four Horsemen that sets them apart from other aerial exhibition groups. The aircraft used are regular line C-130s assigned to the 774th Troop Carrier Squadron. There are no special provisions established for support or maintenance out of normal squadron routine. Only the aircraft commanders and flight engineers are considered permanent members of the Four Horsemen team, and this is necessitated by the practice required.

Thus, to a large degree, the educational and inspiring performances of the Four Horsemen are a product of the entire unit, and the safety record of "never so much as a scratch on the paint" through a long list of presentations is community property of the entire squadron.

The aircraft commanders who wear the insignia of the Four Horsemen do not profess to be particularly daring or distinguished in any way from other pilots. The purpose of their presentations is simply to demonstrate the polished professionalism that has become an inherent feature of tactical troop carrier units.

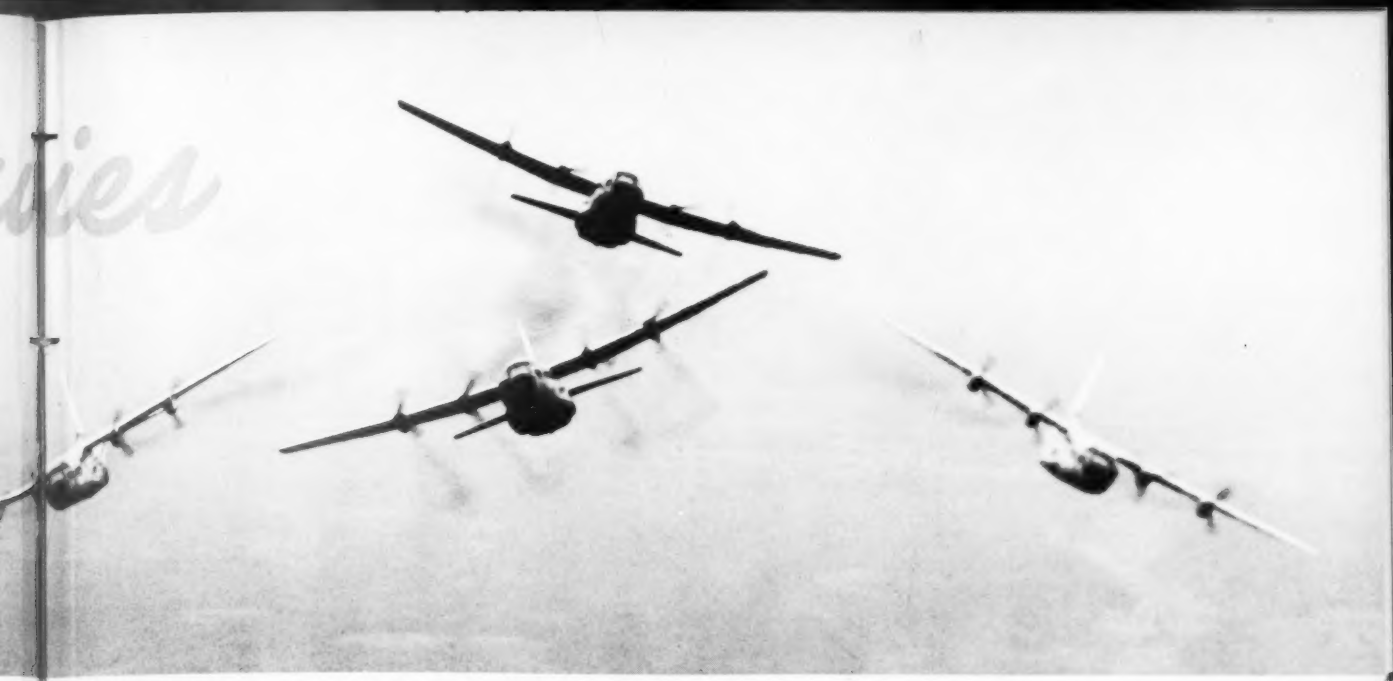
The high-speed logistic aircraft has become a permanent part of the airpower picture, and there is a lot of gratification in maneuvering a 50-ton machine with the same precision by which a master horseman controls his mount with a silken thread. There may be glamor and excitement associated with Mach 2 interceptors, but satisfaction can be found in flying the heavies.

SOMEONE'S ROCKING THE BOAT. *tons of high-speed aircraft scar in all perform this heavy-duty versa of the*

ARM IN ARM. *sels trying g gardenath, th in perfect alig complete of*

EVER HAD A FEELING YOU'RE B *Vertical stabilizer on lead plan bisects mathematical exactness. Close quarters*

THE FOUR HORSEM. Fro *bert E. Chaney, Willia J. Hat Moore. All are instruct pilots*



THE DAT. *Two hundred ft scatter in all directions to form of the bomb burst.*

RM ARM. *Like plump dams trying girlishly down the Ardenwath, the heavies re-form perfect alignment following complex of aerial maneuver.*

G YOU RE BEING FOLLOWED? *plane bisects nose of slotman with Close quarters at 350 miles per hour.*

RSEMEN. *From left to right: Captains Hu- William L. Hatfield, James F. Akin, David L. struct pilots with more than 4,000 hours.*

The Fourth R

The Air Force Reserve Officers' Training Corps is an outgrowth of Army ROTC, rooted deep in U. S. colonial history. As early as 1783, Gov. DeWitt Clinton of N. Y. was asked by General Washington for his views on future defense of the Republic. He recommended military training in colleges and schools. This eventually led to "the fourth R"—reading, 'riting, 'rithmetic and ROTC.

In 1819, the American Literary, Scientific and Military Academy (now Norwich University) was founded by Alden Partridge, former U. S. Military Academy superintendent. During the next 40 years additional military colleges were established, among them VMI and The Citadel.

During the early days of the Civil War, Union military reverses staggered the North, which was wholly unprepared for war. To guard against recurrence, Congress in July 1862, enacted the Morrill or Land-Grant Act, foundation of the ROTC program. Its purpose: to facilitate establishment in every state of at least one college in which military tactics would be taught, so there would be a nucleus of educated citizens familiar with principles of military science.

By the outbreak of World War I in 1914, government-aided military training was conducted in 50 land-grant colleges, 13 other institutions of collegiate rank, and 41 essentially military prep schools. The original National Defense Act of 1916 established ROTC as source of officers for newly authorized Officers' Reserve Corps.

During 1916-17, ROTC units with student enrollment of more than 40,000 were established at 62 collegiate institutions. In 1918 ROTC was temporarily suspended in favor of the Students' Army Training Corps. It resumed operations in 1919. First class of 190 graduates received commissions in June 1920. By the time ROTC was again suspended in World War II, in favor of Army Specialized Training Program, more than 159,000 men had been commissioned. Of these, over 100,000 served in World War II.

In 1920, Air Service ROTC units were established at the Universities of California and Illinois, MIT, and Texas A&M. The next year two more were added, at Georgia Institute of Technology and the University of Washington. By 1935 these units were phased out.

But in 1946 the AAF re-entered the ROTC field, activating air units with an enrollment of about 8,700 students at 87 institutions. From this modest post-war beginning, AFROTC has grown to its present size.

TOMORROW'S OFFICERS

by Dave Karten, *Airman Staff*

WHEN 3,500 Air Force second lieutenants sign into unit orderly rooms after graduation from 175 civilian colleges and universities this month, they'll be targets for some healthy ribbing:

"Are you old enough to shave lieutenant?" "Can you fly airplanes yet?" "Is your scoutmaster with you?" "You graduated from ROTC—what's that?"

Four thousand college students who will descend on 16 air bases this month to begin four weeks of Air Force ROTC summer training will get similar joshing.

The impression is around that AFROTC graduates are airmen in the Junior Birdman or Eagle Scout class. Anyone who thinks so has a lot to learn.

More than at any other time in U. S. peacetime history, the Air Force depends for its career officers not primarily on the service academies, the aviation cadet program, or OCS, but on civilian colleges and universities. Big source of supply: the Air Force Reserve Officers' Training Corps, which now has some 100,000 members—about one-twentieth of the Nation's male college population. This year 3,500 AFROTC seniors will get commissions and fulfill their service obligations by entering active duty for at least three years.

This is in striking contrast to the pre-World War II

"Those who would enjoy the frui of

ROTC which in 1939-40 had only 90,000 members for all the services. Although in the 20s and 30s it was a favorite target of left-wingers and pacifists, ROTC did turn out a lot of highly qualified officers (including Generals LeMay and Schriever). When World War II broke out, the U. S. was able to quickly call 58,000 ROTC graduates from civilian life. Many acquitted themselves with honor and distinction.

Today's peacetime ROTC is bigger and better than ever, but it also faces a greater challenge. This is especially true in the Air Force where the need for officers with special education and training is greatest.

Increased emphasis on missiles, and the complexities of modern weapon systems and their use have produced special requirements for scientific knowledge among our Air Force officer corps. As Under Secretary of Defense James H. Douglas recently expressed it, "We have to have the technical knowledge if we are to operate an Air Force equipped with supersonic aircraft and ballistic missiles."

There are AFROTC units at such leading engineering schools as MIT and California Institute of Technology; at liberal arts colleges like Colgate and Sewanee; in essentially military schools such as Texas A&M and The Citadel; at land-grant schools like Purdue and Ohio State; in Ivy League schools such as Harvard and Princeton; and denominational institutions like Notre Dame and SMU.

Because some of today's ROTC men will be the Air Force leaders of 10 to 15 years hence, there is meticulous selection of students going into the program. Cadets who now enter Air Force ROTC must possess not only the qualities and attributes essential to military leadership but the majority must be willing and qualified to achieve mastery of the basic skill of the Air Force—flying—as pilots or navigators.

Preparation of the AFROTC cadet usually begins the day he enrolls in college. It continues for as long as he is in the program. The training is both academic and military. Along with regular college studies, cadets are given classroom instruction by Air Force officers in air science courses.

To insure that future AFROTC graduates will possess the uniformly high level of military education and knowledge required to provide Air Force junior officers with growth potential, a generalized curriculum is taught.

The air science courses are the product of extensive planning by Air Force and civilian educators. Such leaders as Father Francis P. Cavanagh, former President of Notre Dame, and Dr. Arthur S. Adams, President of the American Council on Education, helped plan and develop the curriculum.

The four-year AFROTC program is divided into two parts. The basic course, in the first two years, serves to acquaint college students with the Air Force as well as to provide candidates for the advanced course. Because not all cadets will become Air Force officers, emphasis in the basic course is on citizenship in the Aerospace Age.

In addition to the academic phase of the preparation, cadets receive basic military training in drill, Air Force customs and courtesy, and leadership. They are organized into flights, squadrons, groups, and wings. Cadet officers and noncoms, under supervision of Air Force personnel assigned to the school, conduct the military training of the other cadets. This is called the "leadership laboratory."

Cadets in the basic course spend approximately two hours each week in the classroom, one hour a week in the leadership lab.

Air Science 1 (freshman year) begins with a general survey of airpower, covers elements of aerospace power, and basic aeronautical science. It describes the role of the Air Force in the defense structure and the professional opportunities available in the Air Force for college graduates who complete the AFROTC program.

In Air Science 2 (sophomore year) which requires

rui of democracy must be willing to bear arms in its defense."

Alexander Hamilton 1757-1804

University of Florida AFROTC leadership lab instructor teaches a cadet how to use his voice when giving commands.

the same number of hours participation, the combat and peacetime organizations and operational capabilities of the USAF, past and present, are examined. Treatment of aerial warfare includes targets, weapon systems, delivery vehicles, bases, and operations. A central theme of study is the concurrent development of new weapon systems and adaptation of new strategy and doctrine for maximum effectiveness.

The basic course serves as a base from which to select advanced cadets who may go on to become junior officers of the Air Force. It also exposes thousands of college undergraduates to at least a smattering of military training and a better understanding of the Air Force mission.

The advanced course, taught in the junior and senior years, is restricted to cadets who have been selected after continuous screening that insures they meet the established physical, mental, and character requirements for a Reserve commission in the Air Force.

To qualify for the advanced course and eventually a commission in the USAF, the cadet must pass an Air Force Officer Qualification Test—a battery of tests that requires eight hours to complete. They produce stanine scores which provide a fairly accurate indication of a cadet's probable success as a pilot, navigator, technician, or administrator. Minimum qualification scores are established for acceptance. After passing the tests, the cadet must pass a regular flight physical if he is a category I (flying) cadet. His academic record for two years is thoroughly reviewed and evaluated. Yet, after all this, he's still not in the advanced program. Now he meets a board of Air Force officers and institution faculty members who weigh all factors and make the final selection.

Those qualifying for pilot or navigator training sign a contract to serve on active duty for five years. Other advanced students, selected for technical or administrative careers in the Air Force, must agree to serve on active duty for at least three years.

The advanced course in the junior and senior years, concentrates on development of the cadet as a prospective junior officer of the Air Force.

In the third year the program is concerned with officer development, and includes in the curriculum such subjects as staff processes, problem solving, base functions, human relations, oral and written communication, leadership, and management.

The fourth and final year of AFROTC continues further development of the cadet as a leader. Here the curriculum stresses international relations and the military aspects of world political geography.

The last year of AFROTC is designed to complete the general training of the Air Force officer before he specializes in one of the many career fields open to him on active duty.

Students find that the air science courses can be as valuable to their education as any other social science course; that AFROTC subjects mesh easily with the rest of the academic program, relating to it and enriching it in many ways.

A summer camp program of four weeks is provided for students who have completed the first three years

of instruction. There cadets participate in operational problems involving the use of aircraft and missiles and are encouraged to make practical application of the theoretical and technical courses studied in the classroom. This summer such training will take place in five major Air Force commands—SAC, TAC, ADC, ATC, and ARDC. Summer training gives the cadet his first real taste of Air Force life, a better understanding of the Air Force mission, imparts career motivation, and provides junior officer training. It also serves as an important selection and screening device; cadets who show lack of officer potential at summer training are eliminated from the program.

By the time summer training is over, the cadet knows something of the routine of Air Force life; is more confident of his ability to give and take orders. He has learned what it means to function as part of a team.

Each of the 175 colleges and universities which host AFROTC has a Department of Air Science headed by a senior Air Force officer who is Professor of Air Science and commander of the AFROTC unit. The faculty members of the department are also carefully selected Air Force officers. The universities and college provide necessary facilities and services for the AFROTC unit; integrate the courses into their curriculum; establish air science departments; grant academic credit for successful completion of AFROTC courses; and endeavor to promote and further the objectives for which the program is organized.

In addition to personnel, the Air Force furnishes supplies and equipment; provides each student with a uniform and military textbooks; and pays every advanced-course student a nominal allowance of 90 cents a day.

Increased emphasis on missiles, and complexities of modern weapon systems have produced special requirements for scientific knowledge among our officer corps.

University of Virginia AFROTC cadets receive instruction on use of instruments in Cessna T-37 primary jet trainer. Flight instruction program includes 35 hours of ground school, 36½ hours of flight training.

Public Law 879, passed by Congress in 1956, authorizes an AFROTC Flight Instruction Program. It is conducted by contract between the university and a civilian contractor, is supervised by the Federal Aviation Agency, and employs aircraft ranging between 65 and 200 h.p. The course consists of 35 hours of ground training and 36½ hours of flight training, and may lead to a private pilot's license. Washouts from this training revert to navigational or nonflying categories for appointment. The Flight Instruction Program provides a great incentive for young college students to learn to fly and to make the Air Force a career.

The Air Force also needs first-rate engineers and administrative specialists as well as technicians to maintain its aircraft, weapon systems, communications, radar, and guided missiles. Today, when we are riding the shockwave of the tremendous technological explosion that followed Sputnik and Lunik, the extraordinary progress achieved through recent technical advances has made the nonflying officer who is a specialist in engineering, science, and technology invaluable.

Air Force ROTC produces second lieutenants who have high growth potential, but they are still green young college men who are not military officers in the true sense of the word. The courses they have taken provide them with well-rounded backgrounds just as any liberal arts education is intended to produce. Skilled training is provided later.

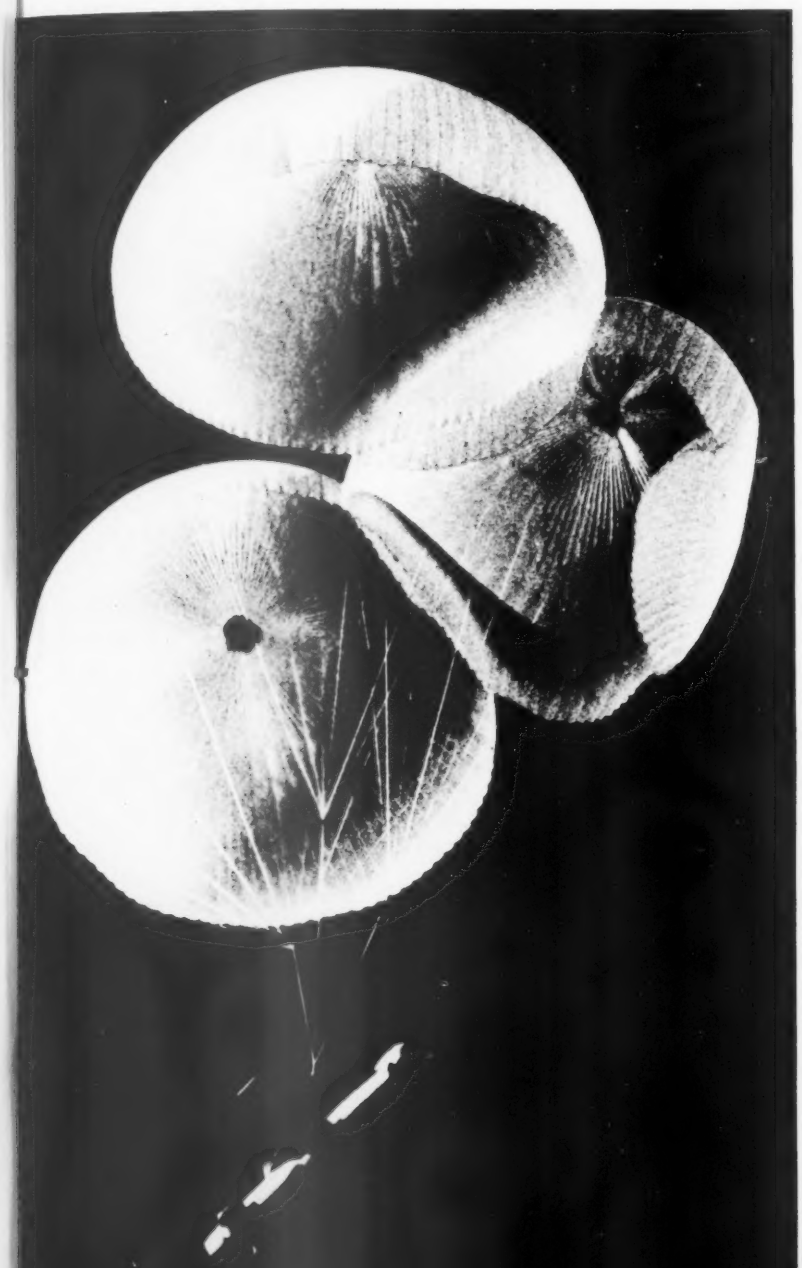
General Thomas D. White, Chief of Staff, put it this way at a recent Institutional-USAF Conference on AFROTC Affairs: "The Air Force will need 'down to earth' leadership of the highest calibre. This means we will need good men with brains, imagination, initiative, force, and solid moral courage. The Air Force ROTC is the only program which has proved its capability to meet this requirement. That's why the Air Reserve Officers' Training Corps is so vital to our Nation's security."

The Air Force requirement for officer personnel is becoming more and more critical. Accelerated hardware development for the maintenance of deterrence in the Aerospace Age underscores the need for quality officer personnel if these weapon systems are to be effectively developed, controlled, and employed.

Since 1951 the program has produced over 64,000 officers. An estimated 34,000 of those now on active duty came from ROTC, which furnishes approximately 4,000 of the 9,500 new officers who come into the Air Force each year. This is roughly 42 percent of the total input compared to the 58 percent provided by all other procurement sources such as aviation cadets, officer candidate school, service academies, and others.

How well the Air Force motivates these ROTC officers after they are assigned to active duty as second lieutenants may very well determine the effectiveness of the aerospace force 10 to 15 years from now. For on the college campuses of today are many of the leaders of tomorrow's Air Force.

AIRMAN'S WORLD



ECONOMY vs. REALISM *has long been one of the major problems in missile testing and training. Recent developments, however, are producing multiple recoveries which save several hundred thousand dollars annually. Here a TM-76* Mace *is gently lowered to earth by a trio of oversized 100-foot 'chutes at the completion of its normal run. The landing is further softened by supplemental air cushions. These "recovery bags" are neoprene-coated nylon fabric, shaped like giant sausages, released from special sections in the missile's belly, and popped into shape by compressed air.*

PEOPLE—Men and the F-100
EVENTS—Aid to Agadir
BOOKS—Paperbacks in review
PANORAMA—Space station

People

WHO MADE NEWS THIS MONTH

A SPEEDING JET this month figured prominently in what is probably the most novel enlistment in USAF annals. It took place at Luke AFB, Ariz., in the rear cockpit of a North American F-100F. SSgt. Lawrence Symes was sworn in by Maj. George Hansen while flying at 41,000 feet and 800 m.p.h. In addition to his reenlistment papers, Sergeant Symes also received a Mach Buster certificate and pin when he landed.

ALSO AT LUKE, Capt. Max L. Templin III, an instructor pilot, was inclined to credit everyone but himself for the fact that he recently became the first man in the base's history to score a perfect record on an air-to-ground target during a practice gunnery run. Fourth in his flight to "attack" the stationary target, Captain Templin placed all 108 color-coded shots in the bull's-eye.

NECESSITY often mothers more than invention. Recently it led to the foundation of a school for the visually handicapped at San Bernardino, Calif. Driving force in the establishment were SSgt. Bart Azzaro of March AFB and his wife Vickie. Their six-year-old daughter, Laura Lee, is numbered among those unfortunate children who suffer from impaired vision. The closest certified school was some 35 miles distant and provided a major transportation problem for the Azzaros.

The city of San Bernardino could not authorize use of its educational facilities unless 10 pupils could be found to attend the special class. Sergeant and Mrs. Azzaro began a determined door-to-door canvass of the local area and soon acquired the minimum number.

COL. GLENN T. EAGLESTON, who scored 26½ combat kills in WW II and Korea, added the Legion of Merit to his many decorations recently. Cited for his "dynamic leadership and faultless judgment" in handling a difficult post-crash situation in Okinawa, Colonel Eagleston was decorated in formal ceremonies at Kadena AB. A year ago an Air Force jet crashed into the village of Ishikawa, killing several persons, injuring a score of others, and causing widespread destruction. The colonel promptly organized emergency aid which included setting up field kitchens and a hospital, rehabilitating several damaged buildings, and providing temporary shelter.

AN F-100 *Super Sabre* also triggered an accidental improvement in aerial fighter refueling. Because of its position, the refueling probe of the F-100 makes hookup a difficult problem. On a recent training mission, however, Col. William Curry, Cannon AFB, N. Mex., happened to draw an F-100 on which the probe was bent slightly upward from its normal position. The result was a considerably eased refueling contact. Colonel Curry formulated a plan and received approval to try it. Six local *Super Sabres* were fitted with probes deliberately bent into an S-shape. Tests proved highly successful and TAC has approved incorporation of the improvement on all assigned F-100s.

Recent inspector of* THE AIRMAN *facilities was Brig. Gen. James Stewart whose M-Day assignment is Deputy Director of Information. The General discusses layout with Art Director SMSgt. L. B. Bounds during active-duty tour visit.

BRIEFS

. . . All good things come in pairs and the Wilson family is making no move to disrupt that tradition. MSgt. Thomas Wilson recently celebrated his 37th anniversary in uniform at March AFB, Calif. A few days later, his son, MSgt. Forrest, completed his 19th year. The latter is stationed with the Military Attaché's office in Lima, Peru.

. . . Another pair made news recently at Sheppard AFB, Tex. Lieutenants Gunel Zeylan and Gulbin Buyuktuzan of the Turkish Air Force became the first women students to attend technical school at Sheppard under the Military Assistance Program.

. . . The 4080th Strategic Reconnaissance Wing, Laughlin AFB, Tex., was recently presented with the Outstanding Unit Award for its work in connection with sampling of particles and gaseous materials present in the upper atmosphere as a result of nuclear weapons tests.

. . . Sole Air Force winner in the recent Inter-Service Pistol Championships at Lackland AFB, Tex., was Lt. Franklin C. Green, an instructor at USAF's Marksman School. Lieutenant Green fired 289-Z12X over a National Match Course at 25 and 50 yards with a .45 calibre pistol.

Events

THAT REFLECT AIR FORCE PROGRESS

A TIP OF THE AIRMAN'S hat to USAF troops throughout Europe and North Africa for responding so quickly and unselfishly to the recent disaster at Agadir. Within hours after the tragedy, rescue crews, equipment, medical supplies, casualty airlifts, doctors, nurses, food and water, blankets, beds, tents, and other aid poured into the area.

SAC recently announced entry into their inventory of a new type of aircraft—the H-43B helicopter. Holder of the world altitude mark in its category, the *Husky* will be used primarily for crash-rescue work and missile support operations. The wedding of missiles and manned aircraft has increased SAC's deterrent capability to a new high, and adoption of the *Husky* will provide an overall support weapon for both phases of SAC operations.

THE REALM of new developments also reached into NORAD's future recently with the approval for a new subterranean nerve center, construction on which is expected to begin in the near future. The command post will be "holed up" in the rugged Rockies, west of Colorado Springs, Colo. From it, U. S. defensive forces will be directed with assurance that their operations will be guaranteed immunity from destruction. This factor becomes increasingly important in view of the fact that these forces complement and protect our offensive units thereby insuring their capacity for full retribution on an attacker.

STILL on the subject of air defense, ADC officials have announced that seven additional fighter squadrons will join the six presently equipped with Convair F-106 *Delta Darts,* in staggered stages this year. The transition is expected to be completed sometime early this fall.

THREE EVENTS should make major USAF news in coming weeks. At the close of the current month, ATC contract flying ends at Malden AB, Mo., leaving the Air Force with only five primary-flying training centers—Moore AB, Tex., Spence and Bainbridge ABs, Ga., and Graham and Bartow ABs, Fla.

ATC also announced that the Orville Wright Achievement Award will be initiated in July for presentation to outstanding graduates of the primary pilot training program. The award has been established by the famed Daedalian Foundation.

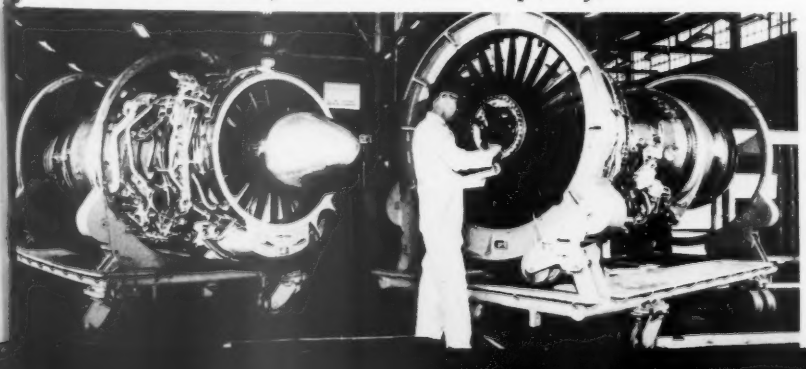
Finally, in the realm of events to come, SAC has announced the activation of the 548th Strategic Missile Squadron *(Atlas)* scheduled for next month. The unit will be assigned to Forbes AFB, Kans., and will operate at a new nearby site.

A PREDICTION made in THE AIRMAN more than a year ago is about to materialize. A. L. Chapman, Assistant Surgeon General of the U. S. Public Health Service, stated recently that automobile seat belts seem certain to become standard equipment in the near future because of their high value in preventing fatalities and grave injuries. The belt's value was emphasized in a January 1959 article entitled *Fasten Seat Belts.*

TAC's Composite Air Strike Forces promise to reach a new high in flexibility with an additional supply of rubber. Designed as tactical units capable of moving quickly into trouble areas and operating from isolated sites, CASF has always faced a refueling problem in such areas. Now, however, an Air Transportable Hydrant Refueling System is undergoing tests at Myrtle Beach AFB, S. C. If it proves feasible, these portable units will be assigned to all such forces. Each is capable of handling a total of 50,000 gallons of fuel from deflatable rubber bags which are equipped with their own built-in filter systems.

AN air traffic controller and a helicopter crew shared equally in a brilliant rescue effort in Korea recently. Two ROKAF F-86s collided in mid-air, sending both pilots parachuting to safety about 40 miles from Osan AB. SSgt. Lee Faull intercepted the Mayday call in the Osan control tower and immediately diverted a helicopter he had just cleared for a local flight. Both pilots were picked up and returned to the local base within an hour.

CONTRAST IN POWER UNITS *is pointed up with first pictures of the new TF-33-3 turbofan engines which will power the Boeing B-52H. On the left is the J57-P-43W turbojet which serves as one of eight power plants for the B-52G. The latest version of SAC's first-line bomber will be armed with* Sky Bolt *ballistic missiles, replacing the current* Hound Dog *of the "G" model. In short, both versions, by combining manned aircraft and missiles, become sky-borne launching pads and increase SAC's already immense deterrent capability.*



Panorama

OUR AIR-MINDED ANCESTORS

"Military aviation must remain a part of the Signal Corps until it is able to take care of itself."

Lt. Henry H. Arnold
August, 1913

(Taken from testimony given before the House Military Affairs Committee during hearings on the creation of a separate organization for military aviation.)

September 22, 1938, a brief quarter of a century later, Maj. Gen. H. H. "Hap" Arnold was appointed Chief of the Air Corps. Less than a decade elapsed before military aviation was judged capable of taking care of itself. It gained autonomy in September, 1947.

BOFFS IN BLUE

In mid-1942, Lt. Richard I. Bong, later to become America's winningest ace, was reprimanded for buzzing in the San Francisco area and for looping his P-38 around the center span of the Golden Gate bridge. As punishment for his illegal acts, Gen. George C. Kenney chose to assign the youngster to a duty which would offset the complaint of a local woman who claimed her washing had been blown from the line by Bong's prop-wash.

Concluding the "assignment" statement with "I want that woman to think we're good for something besides annoying people," General Kenney instructed Lieutenant Bong to go to her home, do the washing, hang it out, mow the lawn, and do odd-jobs while it dried, then take the laundry back into the house.

FOR THE PROFESSIONAL AIRMAN

To keep abreast of current policy, airmen should keep up with constantly revised Air Force publications such as some of the more important revisions listed here.

AFR 26-6, *Reduction-in-Force.*

AFR 32-11, *Safe Driver Awards.*

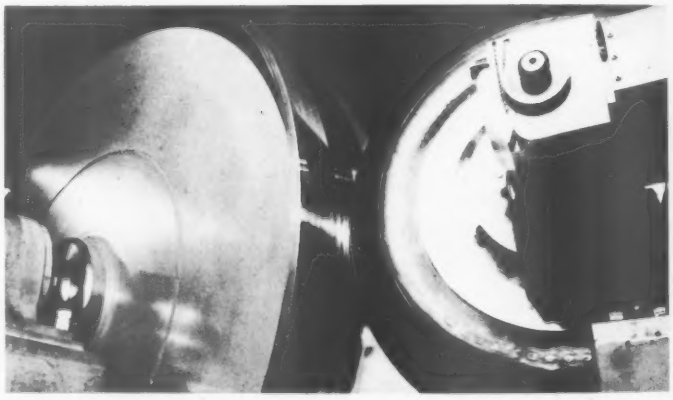
AFR 35-3A, *Service Dates.*

AFR 36-15, *Project M Promotion Evaluation.*

AFR 36-40A, *Officers Control Procedure.*

AFR 39-29, *Promotion of Airmen.*

AFR 39-45A, *Proficiency Pay.*



RESEARCHERS ARE ATTEMPTING ***to prepare for almost any eventuality in the rapidly progressing field of aviation. One of the constantly recurring problems is that of tires and tire wear. Through the magic of electronics and the brute force of high-powered motors, Goodyear has devised torture tests which allow stress testing at speeds in excess of 500 m.p.h.***

MAN'S FIRST INHABITED SPACE STATION ***may be packed in a small container as it leaves the earth, blown into shape like a balloon when it reaches orbit, and "rigidized" by quick-setting plastic. This artist's conception illustrates the activity that may be required to fit the pieces into a workable unit.***

The Airman

Aerospace Library

Periodically, in answer to reader requests, we list the latest in aviation paperback publications. Current works are of an exceptionally high calibre and should be a welcome addition to any airman's library.

First is *Space Primer: An Introduction to Astronautics.* Technical in nature, the booklet is designed to present a simplified orientation to the basic principles of missiles, satellites, and space flight. A small number of free copies are available from Convair-Astronautics, P. O. Box 1128, San Diego 12, Calif.

Also in the technical category are *Strategy,* B. H. Liddell Hart, ($1.75), and *Space Weapons,* by the editors of *Air Force/Space Digest,* ($1.45), released by Praeger.

New American Library has also released two excellent books—*The Rainbow and the Rose,* Nevil Shute, (.50), and *The Memoirs of Field Marshall Montgomery,* (.75). The former is one of the late Mr. Shute's excellent novels.

Three fine books are now available from Ballantine. Two fall within the historical category.—*American Aces in Great Fighter Battles of WW II,* Edward Sims, (.50), and *The Coast Watchers,* Comdr. Eric Feldt, R.A.N., (.50). The third is a collection of Frank Harvey short stories entitled *Air Force,* (.35).

Pocket Books also enter the field of multiple releases currently in the best-selling category. *Masters of Deceit,* J. Edgar Hoover, (.50), certainly needs no introduction, and Don Whitehead's *FBI Story,* (.50), makes an excellent companion piece.

The Other Side of the Sky, Arthur Clarke, (.35), released by Signet, weaves a fascinating picture of science by an expert in the field.

Cowan has released *All About Missiles and Satellites,* David Mark, ($1.50). It might be categorized as a basic handbook for this field.

H. E. Nehrens has compiled *The Dawning Space Age,* ($2.00), and it is available from Civil Air Patrol. It was written primarily as a text for CAP Cadets.

A Rand Corporation staff report provides a fascinating study of space technology and it is available under the title *Space Handbook,* ($1.25), Modern Library.

Finally, *A Man Escaped,* Andre Devigny, (.50), tells of a dramatic escape from a WW II POW camp. Berkeley is the publisher.

Most of these publications should be available in base exchanges or libraries.

You Ask It

Q. I am being discharged this month but desire to stay in the active Reserve. What steps must I take?

A. If you have a Reserve obligation, you will be given a letter of assignment and instructions. If not, upon separation, contact the Reserve organization nearest your home and let them know of your desire.

Q. In order to extend my current overseas tour, how far in advance must I apply?

A. Applications for such extensions should be submitted no earlier than 12 months nor later than nine months prior to the normal date of rotation.

Q. I understand that the policy governing requests for retirement has been changed. Does this affect the submission date?

A. Yes. You may now apply 180 days in advance of the requested retirement date.

Q. Is it possible to use my GI insurance dividends to keep my policy from lapsing?

A. Yes. Before your next dividend is due, ask the VA to hold it for you as a credit. They will explain their procedure for applying it to your premiums.

Q. I have heard a great deal in the last few months about the restoration of certain Medicare benefits. Would you explain what these are?

A. Effective on January 1, 1960, the following types of care were restored: certain surgical services, treatment for acute emotional disorders which constitute an emergency, pre- and post-hospitalization tests and procedures, and treatment of injuries on an outpatient basis. (See DOD Fact Sheet 2-D, 4 Jan 60, on *Restoration of Certain Care.*

Q. Is civilian care for all types of services now authorized?

A. No. Among those which are not included are post-natal visits after release of the infant from the hospital, chronic diseases, domiciliary care, and medical supports or aids. Again, it is best to consult local officials.

Q. Is dental care ever authorized?

A. Yes. However, only when patients are hospitalized for other authorized care and it is required as a necessary part of the treatment of the basic medical or surgical condition. Even then it does not include the cost of artificial teeth, bridges, fillings, and similar services.

THE SOUNDING FIRMAMENT

by William A. Kinney, Airman Staff

Conclusion

KARL JANSKY'S discovery of radio astronomy has been aptly likened to the opening of a wide new window on the universe.

Through this window the cosmos ceases to be solely the immense pageantry so intently conned by the optical telescopes of astronomers ever since Galileo's day. It becomes a far more crowded, mysterious and complex realm, strewn with myriad unseen energy sources which pour high intensity radiations into trackless space.

For science, the revelation was revolutionary in implication, affecting widely accepted beliefs on the structure and mechanism of the universe.

For a space age that was yet to come, the event spelled ready assistance in coping with some of the urgent immediate problems ahead and also a longer range significance still being assessed.

Mention of a new window obviously raises a question of the old one. Both are complementary because each admits certain bands of the extraterrestrial radiation reaching our planet's surface.

At the time Jansky began his historic research on a New Jersey farm in 1930, it was well known that vast amounts of radiant energy showers constantly on the outer atmosphere, the greater amount of it directly from that very ordinary yellow star we call the sun. These radiations, essentially the same in their nature, travel at the speed of light—186,000 miles per second—but each kind travels on its own separate wavelength and this fact accounts for their different properties or effects. Taken together, these wave energies are known as electromagnetic radiation.

The traditional electromagnetic spectrum with which science was familiar three decades ago consisted of gamma rays, X-rays, ultraviolet rays, visible light (or luminous energy), and infrared radiation. Most of these radiations either never reach our surface or are changed in form. They are absorbed, filtered out, or undergo change by passage through the atmosphere.

Visible light, however, penetrates down through a long, extremely narrow atmospheric aperture, so to speak. This is the so-called optical window and an infinitesimally tiny window it offers—only a few millionths of a meter wide in an energy spectrum extending from less than one trillionth of a meter to (as we now know) more than 10,000 meters.

To this paltry slit have visual astronomers been confined for all observations of the neighboring and distant solar systems. Our normal mental image of a window is something set more or less flush in the side of a structure; one can look not only straight ahead through it but also have a goodly field of lateral vision, too. Not so with this optical window. It is deeply recessed in an atmospheric wall hundreds of miles thick. A telescope using the window might be compared to an instrument pointed upward at the sky from the bottom of a cramped shaft at an abysmal depth below the surface.

Radio Waves Overlooked

In retrospect, it is difficult today to understand why science was so laggard in realizing that radio waves were still another type of electromagnetic radiation and as much a part of that spectrum as visible light. Indeed, the existence of natural radio waves was theoretically predicted by a physicist as far back as 1873. Fifteen years later this kind of radiation was experimentally produced under laboratory conditions. Then in 1896 Marconi successfully harnessed such waves for practical use with his invention of wireless telegraphy. The remarkable development of radio communications which presently began is a unique and familiar story.

Despite the increasingly wide research this development involved, evidently there was no serious questioning of the assumption that radio waves were strictly a manmade phenomena. If radio reception was subject to no little interference in these earlier days, the bulk of it could be traced to "noise" radiations generated by

electrical equipment, also of man's creation. True, lightning storms could be quite disruptive but atmospheric conditions were considered the villain in such cases. As for the less strident varieties of static, any investigation was cursory or unrewarding until Jansky started his sleuthing to track down the origins of unidentified interference.

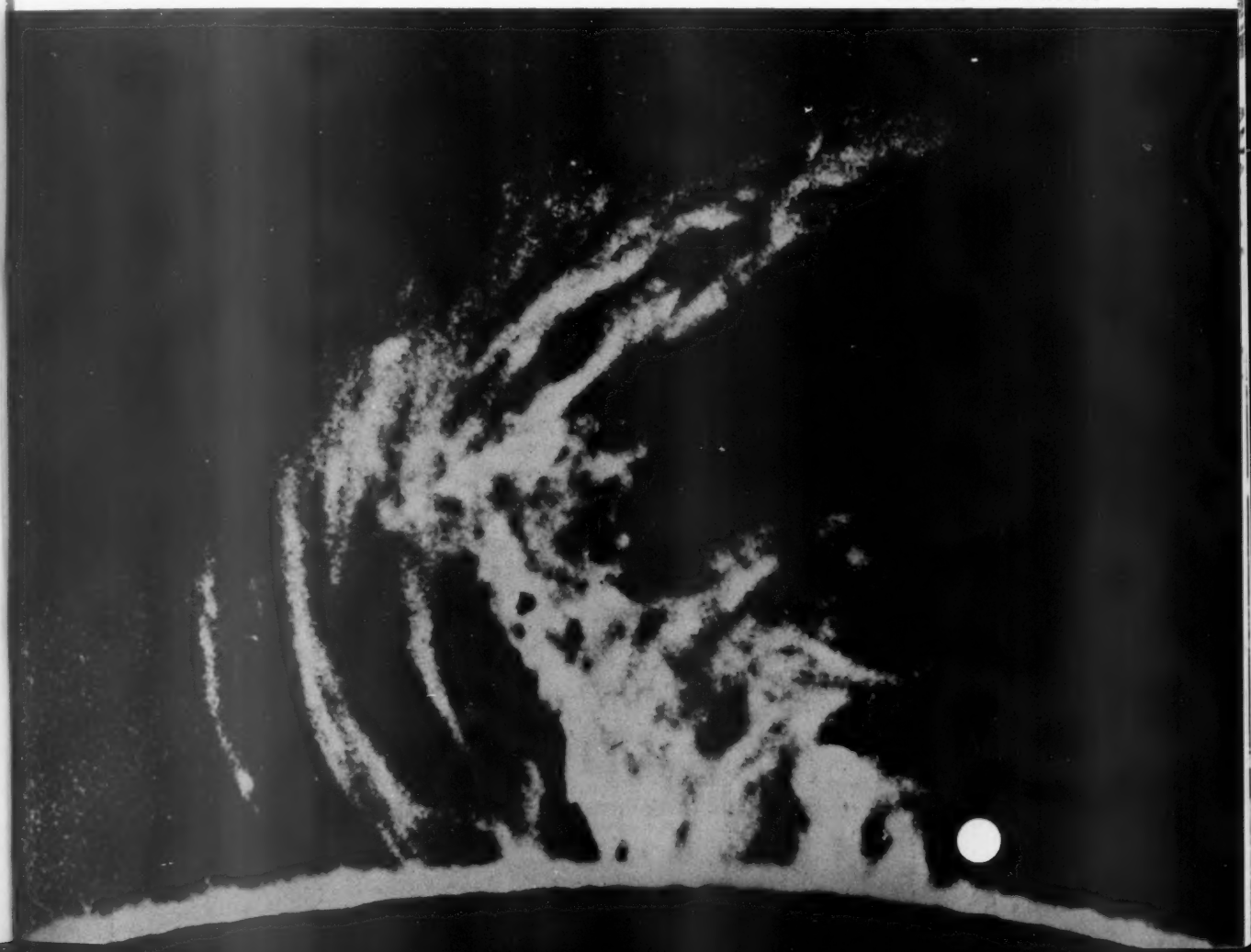
The idea that radio waves might emanate from celestial sources had been propounded more than a quarter of a century earlier but evidence is overwhelming that it exerted no influence on Jansky's approach to his task if, indeed, he had ever heard of the hypothesis at all. Its author was Sir Oliver Lodge, who advanced it in 1894 during an appearance before the Royal Institution of Great Britain. In a paper, *Signalling Across Space Without Wires,* this able scientist suggested radio emanations might come from the Sun. When he got the opportunity later to put the theory to a test, however, the unsophisticated equipment at his disposal failed to detect the expected evidence and he reported no such waves could be found.

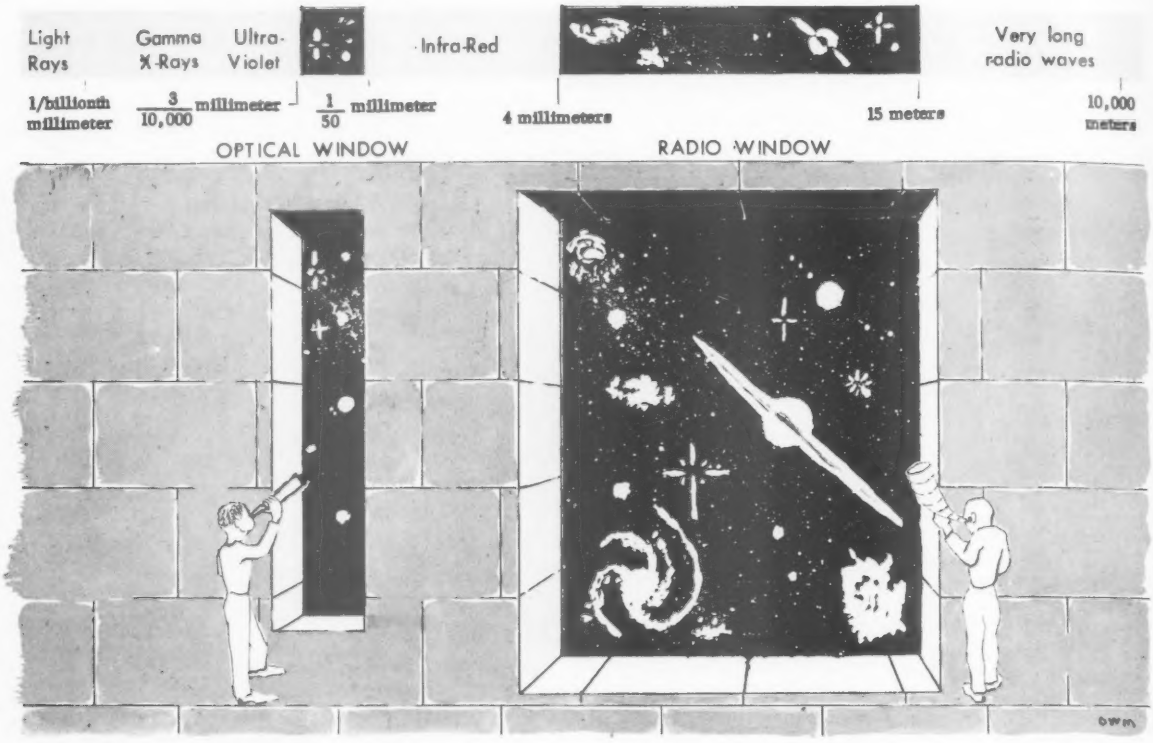
When Jansky was finally able to conclude that the strange radiation he had been monitoring at 14.5 meters (20.53 megacycles) must have its origin in the direction of the Constellation Sagittarius, the Archer, he had the first inkling that "other window" existed. Subsequent research eventually established that normally this radio window extends from about 4 millimeters to 15 meters —more than a hundred times wider than the slim one available to optical astronomy. And that represents the minimum radio window. When very advantageous conditions prevail, the width may enlarge to permit the monitoring of space radiations with frequencies up to as high as 30 meters.

Thus man has at his service an unbelievably broad new spectrum for exploring the exterior universe in

SPECTACULAR ERUPTION ***hurls sheets of glowing hydrogen gas far beyond the surface of the Sun. Disturbance, pictured below, sent the luminous hydrogen formations boiling out as far as 140,000 miles into space from point of origin. Small white disc (lower right) shows relative size of Earth in comparison. The Sun is the most convenient star for radio astronomers to study.***

Photo courtesy Mt. Wilson Observatory





THE TWO WINDOWS ON THE UNIVERSE. ***Visible light is the one segment of wavelengths in the electromagnetic spectrum to which the human eye is sensitive. This represents the observation window to which optical telescopes are limited in their exploration of the universe. Light waves which pass through the aperture are longer than ultraviolet rays but shorter than the invisible infrared variety. The discovery that the atmosphere is also largely transparent to another kind of electromagnetic emanations from space—the radio waves—has provided science with a second, much broader window for celestial studies. The slender optical window is good for observing only on dark clear nights when "seeing" conditions are fine. The spacious radio window, however, may be used 24 hours a day. Schematic diagram shows relative arrangement of the electromagnetic spectrum, but is not to exact scale since a millimeter is only .0394 inch while a meter is 3.2808 feet.***

terms, not of the visible light it sheds, but in the more informative patterns of the electromagnetic radiations being broadcast by a host of hitherto unsuspected natural transmitting stations in space. Since the galaxies are fantastic whirlpools of energy, systematic monitoring of their radiant energies promises in time to unlock for science many of their long-concealed secrets.

The fact that incoming radiations in this broad frequency range could pass through the Earth's dense atmospheric bubble without excessive distortion had a most important corollary for the space age that was to burst unexpectedly upon the world in the not so distant future. Up until the time the significance of the Jansky breakthrough came to be appreciated, engineers were inclined to believe that radio waves were confined to the immediate terrestrial environment by the barrier of an atmospheric "roof." The basis for this belief was that manmade radio waves of various frequencies were reflected back to Earth by the ionosphere layer of the atmosphere.

Now, however, the reception of radio waves from space was unquestionable proof that the ionosphere posed no barrier to a certain spectrum of wavelengths. It followed, therefore, that transmissions from an earthly station could be sent straight outward if the same wide band of frequencies was used. This was highly valuable knowledge when planning had to be done for the telemetering of signals from space vehicles.

Sun's New Look

But let us return to matters astronomical and get things in perspective there. It is possible for both visual and radio telescopes to study certain celestial objects in their respective ways. To optical observation, for example, the Sun is a burning disc of fierce brillance, surrounded by the faintly luminous halo of its corona

which seems only half as bright as a full Moon. The image a radio telescope receives is a comparatively "dark" core—that is, the visible solar disc is not a high power source of radiations transmitted direct to Earth and in other space directions. However, the corona, too dim for satisfactory optical studies, is for the radio instrument an extremely "bright" (i. ., high intensity) generator of signals and stretches out on all sides of the Sun to the astonishing radial distance of more than 8,000,000 miles.

Similarly, radio telescopes have detected a number of other "bright" radiation sources in the heavens where the most powerful optical telescopes find only dark, gaseous turbulence or half-obscured shreds of dim filament structures.

Much of radio astronomy's work to date has been concentrated on celestial radiation sources either dark or wholly invisible to optical instruments. Already, more than 3,000 of these phantom transmitting areas have been discovered by this infant science. Sometimes called "radio stars," they are referred to scientifically as *discrete* (i.e., separate or distinct) *sources*. Some are believed due to exploding gases from a dying star, some by galaxies in collision, and still others by an intense chain of atomic reaction.

For a layman the idea of relying on mere inanimate or inarticulate sound for information may at first seem difficult to accept. If we reflect a moment, however, we find that such reliance is scarcely alien to everyday life. A boy tosses a stone down a well and waits for the splash to tell him whether it is deep or not. A long interval between a lightning flash and its thunderclap is acceptable evidence the storm can't be too near. On a dark morn a waking city dweller can deduce from the increasing drone of traffic that people are on their way to work and, if the tires hiss, that there probably has been rain. There is no dearth of homely examples.

In the military field, radar and other electronic equipment utilize sound in the form of signals to develop intelligence.

Inanimate and inarticulate sounds can be meaningful or meaningless. The determining factor is the ability to identify and interpret. A sound track of rush-hour traffic would conjure no accurate mental pictures for a jungle native, just as a lifelong U. S. city resident would be unable to distinguish immediately between harmless noise in an equatorial thicket or the more ominous kind made by a prowling animal.

An Ear to Space

And what does the noise of space radiations sound like? There is ample variety. Some may suggest ghostly wails or be reminiscent of snapping, crackling, and frying effects. Others have been likened to "a combination of gravel falling on the roof and the howling of wolves." There are sighs, rustlings, roars, hisses, and sizzles. For the most part the sounds are low, steady, and subtle. Occasionally there may be intermittent periods of silence, as with Venus and Jupiter which are random transmission sources. Occasionally, too, signal strength may jump sharply; this is the case with solar radiations during disturbances in the Sun.

How does one go about extracting any useful information from such a discordant mixture? A good question. Space radiations are normally studied against a background of galactic noise, technically known as continuum. This is a medley of sound generated by numerous celestial transmitters and a radio telescope must be able to identify a given individual ration in that jumble. Let us recall our example of the boy dropping a stone down the well. Invariably there would be a background of other sounds for that rural scene. The wind rustling the foliage of trees, perhaps; the cackle of barnyard fowl; the lowing of unmilked cows; a dog's bark; the piping of birds. The boy's ears cannot be said to be insensible to this assortment of other sounds about him but he is concentrating on—or "tuned" to—the sound he waits to hear, the splash. It's a matter of selection.

Similarly, radio astronomy is selective. An instrument is tuned to the particular wavelength selected for study. Radiations emitted by the various physical elements have different frequencies. Hydrogen, by far the most abundant element in the universe, radiates at 21 centimeters. Great clouds of this gas have been located throughout our Milky Way galaxy. By applying the Doppler principle, the relative distribution of hydrogen concentrations with reference to the location of the solar system can be calculated.

Understandably, of more immediate preoccupation with space exploration planners is the partner role radio astronomy can play in developing programs. Here, the question of radiations has some different aspects. Changes are known to occur in the configuration of the Van Allen belts of "hot" radiation encircling the Earth but what causes these variations has yet to be positively established. Information is also lacking as to whether the changes are uniform throughout the belts and whether they follow some timetable, so to speak. Another question concerns the apparently random bursts of radiation which some satellites have detected at no great distance from the Earth. How these bursts originate is not known and likewise how often they may occur in any given segment of the heavens. Radio observations may be able to contribute much toward gradually reducing the uncertainties which such phenomena now represent.

However valuable this systematic investigative work, it will probably be overshadowed for a long period by the yeoman service radio telescopes have come to render as the sensitive "big ears," so essential for keeping track of far ranging space probes. When the first artificial satellites began swinging through their orbits, ground telemetering stations experienced no special problems in monitoring the low power signals which the vehicles could transmit with limited battery strength. As probes fared out to greater distances beyond the planet, however, their voices quickly became lost to the multiple regular links of the ground tracking system. Not so with the large, directional radio telescopes, since

they have been designed to amplify fantastically feeble signals coming in from discrete sources located trillions of miles away in space.

To appreciate the communications problem involved, it should be remembered that the strength of a radio signal decreases in proportion to the inverse square of the distance it travels. To spell this concept out a bit for the uninitiated, let us consider an hypothetical distance of 10 units, each of equal length in unspecified miles. When a receiver is moved from the end of Unit 1 to the end of Unit 2, the signal detected will have only ¼ its initial strength. At the end of Unit 3, it declines to 1/9; at the end of Unit 4, to 1/16; at the end of Unit 5, to 1/25; and so on, until at the end of Unit 10 it has fallen to 1/100.

The strongest celestial radiation regularly monitored* by radio telescopes thus far originates at an invisible source, known as Cassiopeia A, that five-star constellation located in the northern heavens. The power level at which this source transmits has been computed to be 10,000,000,000,000,000,000,000,000 (25 zeros) kw.

Power of this astounding magnitude makes the Earth's resources seem less than trivial by comparison. Last available figures in 1959 place the total world generating capacity at about 500,000,000 kilowatts, with the U. S. accounting for roughly a third of it, or 160,219,000. Our big city TV stations get by on a mere 50 kilowatts and even very high frequency transmitters have power levels of only 1,000 kilowatts.

Of course, radiations from Cassiopeia A spend all but a minor fraction of their enormous original strength in traveling the vast distances they cross before reaching the Earth. Their source is 10,000 light-years distance and in a single light-year the waves must travel 5,880,000,000,000 miles. Hence, when the waves finally arrive over a broad surface of our planet, their combined radio energy amounts to a dwindling 0.10 kilowatt, or 100 watts. Of this widely dispersed wave energy, the most a single big radio telescope can collect and focus is infinitesimal—a signal with a strength of 0.000,000,000,000,001 watt.

An instrument's ability to work with radio waves so feeble depends on three things. Its antenna area must be extensive to collect enough of the incoming radiation to have a signal which can be distinguished. Next, substantial amplifying power is essential to increase signal strength so that recordings can be made for study. Throughout the entire process, energy noises resulting from the operating mechanism of an observatory must be reduced to a minimum for otherwise they would completely mask the faint space waves being picked up.

The trend in antenna sizes has been steadily larger. The biggest steerable dish, now under construction for the U. S. Navy in West Virginia, will have a diameter of 600 feet. Scientists foresee the need for arrays with even greater surface areas. While dish-type antennae have been popularly accepted as the symbol of the young science, they represent a minority of receivers

*Space radiations originating in the constellation of Cygnus, the Swan, are broadcast at power levels between 1,000,000,000,000,000,000,000,000,000,000 (33 zeros) and 1,000,000,000,000,000,000,000,000,000,000,000 (36 zeros) kilowatts. However, this radio source is 270 million light-years away and in traversing that distance the waves become weaker than those from Cassiopeia's before reaching the Earth.

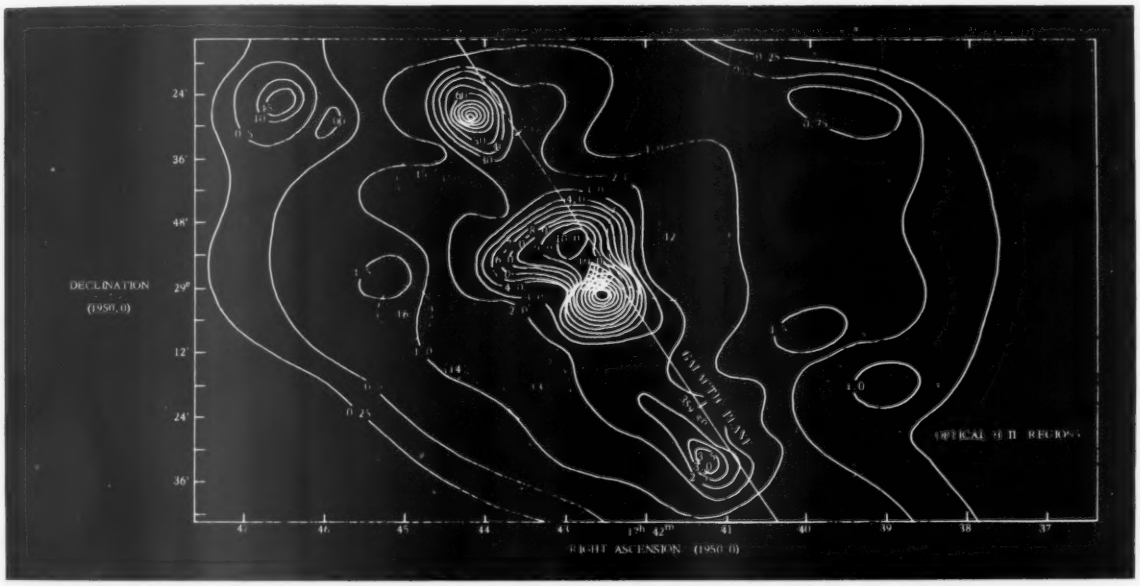
FROM A BUZZING SWARM, A SINGLE HUM. ***To tune in a particular space signal for study, radio telescopes must separate it from a tumult of other electromagnetic radiations, some from galactic sources, some from atmospheric phenomena, and some originating in the receiving equipment itself. The task might be compared to isolating the sound of one bee from the submerging drone of a vast colony, or the whisper of a lone leaf in the murmurous rustle of a great forest. While radio telescopes are called "ears," they "listen" to space by committing received signals to recorder tape or automatically traced graph paper.***

currently in use. Some are stationary aerial arrays on the ground which depend on the movements of the Earth to wheel celestial study regions within observing range. Others have limited directivity. The whole inventory makes quite an assortment of sizes, shapes, and component multiplicity.

Larger antenna surfaces may also increase the resolution of radio telescopes; that is, their ability to distinguish between radiation sources. Currently operational models are unable to secure a distinct, sharp "image" of a celestial transmitter and hence lack the precision which an optical telescope has when observing a visible light source. For example, if two or more radiation points are closer together than 537 miles in angular

Space programs have given an immediate urgency to the acquisition of far more thorough information about the solar system and all its multiplicity of phenomena. However, the solar system is only a minor component of an unbelievably vaster cosmos so there is intensified incentive to investigate the universe as a whole. In that way, it may be possible to arrive at a more enlightened understanding of this one particular part.

While this unprecedented research effort goes forward, the more powerful radio telescopes seem certain to draw continuing extra duty for some time to come in monitoring space communications and transmitting commands, especially for vehicles operational outside the Earth-Moon system.



THE GALACTIC CENTER, ***as it appears at 3.75 cm. wavelength. This drawing is the result of some of the first observations made at the National Radio Astronomy Observatory with the 85-foot telescope.***

location, the big Jodrell Bank instrument cannot separate them and the signals overlap. While there is a recognized limit to the future size of steerable paraboloid antennae, scientists are nevertheless optimistic that ground arrays with some directivity still have good growth potential and will gradually make for improvements in resolution capability. Continued advances in the electronics field also are expected to provide important help.

Mutual Help Act

If the availability of some radio telescopes was a providential coincidence for the opening years of the Space Age, man's progress in the exploration of space has had the salutary effect, in turn, of accelerating world interest in this young science to a far greater degree than might be expected in a relatively uneventful stretch of history.

Available rocket systems still sharply restrict the size of a payload that can be put into space, and the payload's size limits the auxiliary power supply that can be carried for transmission purposes. In the present state of the art, chemical batteries must be relied on for the auxiliary power. These batteries pose a weight problem, if adequate power is to be available for transmission at multimillion-mile distances. There is still some question about their useful life.

The performance of the *Pioneer V's* communication system en route to an orbit near Venus has greatly encouraged hopes about the efficiency of the solar cell rig carried by the vehicle to keep its batteries charged. Some experts, however, still have their fingers crossed, mindful of what happened to the paddlewheel *Explorer VI* last year after a most promising start. Launched into a 23,000-mile-high orbit on August 7, this earlier vehicle was given a predicted lifetime of more than a year.

"IF YOU SEEK A MONUMENT, *Look Around You.*" ***This epitaph for Christopher Wren, architect of many distinguished buildings in Britain, may well be used for Karl Jansky. Across the world a growing number of radio telescopes are symbols of the science he pioneered. Simple marker at the new National Radio Astronomy Observatory in West Virginia reminds visitors its laboratory memoralizes Jansky's name.***

Photo courtesy of Associated Universities

For the first month transmitting equipment operated properly, relaying data from all instruments at a level of 0.5 watt. Then only partial reports came through for another month, and then the satellite went silent. Scientists have since been speculating that it may have swung through an area of intense radiation which altered—and thus killed—the solar cells supplying the batteries.

If this conclusion is correct, then reliance on solar cells to prolong battery life may be something of a gamble. Random bursts of intense radiation are known to occur from time to time in the solar system, so it is a matter of chance whether a satellite runs afoul of one.

Given a charmed life from such natural hazards, *Pioneer V* should furnish the first practical evidence on what auxiliary power requirements are under space operational conditions at multimillion-mile range. A number of theoretical papers have been written on the subject, using formulas found valid for terrestrial communications and conventional equipment. Conclusions have not been uniform.

One frequently cited study calculates that readable voice communications from the distance of the Moon should be possible with a transmitter generating about 0.3 watt, or less than the power needed for a three-cell flashlight, and using a six-foot paraboloid antenna to beam the signals on a three-centimeter wavelength. Another study reaches the conclusion that a power level of 0.5 watt would be found closer to the mark. A dissenter questions the adequacy of either answer and suggests that something in the order of 10 watts may be necessary.

In communicating with a vehicle in the Moon's environment, the distance to be spanned is quite nominal by space standards, averaging less than a quarter-million miles. Venus, however, is a far different story. At its closest approach to Earth, this planet never comes nearer than 24 million miles, or roughly 100 times farther away than the Moon. In the case of Mars, which swings within 35 million miles of Earth, the distance would be 140 times that to the Moon.

According to formulas advanced, voice communications to or from the proximity of Venus would require 10,000 times the power needed for like messages from the Moon. If we assign the transmitter to Martian environment, the power demand is 22,500 times greater.

It should be noted here, of course, that voice transmission is not an economical method of radio communication. Signals to actuate a teleprinter on Earth would take only about 1/1,000 the power, for instance. Even so, it has been estimated that a power level of 180 watts would be about minimum for telecommunications from Venus, and 600 watts from Mars. (Thus far, the most a space device has been able to deliver from chemical batteries stands at 150 watts.)

But that is not quite the whole story. By increasing the size of a transmitting area, power consumption can be reduced. For example, by giving a vehicle in Martian environment a 50-foot paraboloid in place of one only 6 feet in diameter it would be possible to relay messages with one-sixth the power required by the smaller aerial.

Or power economy may be effected in another way. If large transmitting antennae are not feasible for the immediate generations of vehicles, the use of the big arrays of radio astronomy observatories on the ground will do much to give the same result. For example, as a receiver, the Jodrell Bank dish would have the effect of increasing, in a sense, the transmitting area of a 10-foot antenna on the Moon 400 times. With the 600-foot Navy paraboloid now being built, the effective increase would be more than double that.

There are now some 75 major radio astronomy installations operating around the world, approximately a third of them in the U. S. Besides these, there are numerous smaller observatories, many of which concentrate on studies of atmospherics and geophysics instead of astronomical research. These latter programs are not without potential yield for space purposes, however, for we still lack definitive knowledge about the atmospheric environment and phenomena which intervene before the threshold of true space.

The world can do with more "big ears" in the years ahead both for the needs of the new astronomy and for cooperation in the more significant space ventures. Important facilities are still depressingly few in the Southern Hemisphere. This fact has affected the amount of research available on those portions of the heavens visible only from points well below the equator; it also renders difficult continuous coverage of far ranging space vehicles which move through the equivalent of deep southern latitudes in the celestial sphere.

It should likewise be kept in mind that most existing observatories have crowded schedules of strictly scientific work and cannot always be expected to interrupt exacting programs for lengthy periods just to serve obligingly as communications backstops on space projects. As more installations become operational, there is greater likelihood observatories can be found that can conveniently divert time from research undertakings to monitor important data from remote space vehicles.

. . . NOW NOT WITHOUT HONOR

It was just 30 years ago that a young American engineer began the long, persevering quest which was to give science the new tool of radio astronomy for a more searching investigation of the universe.

Today under summery skies in a sheltered West Virginia valley our National Radio Astronomy Observatory is coming to full reality. Work goes forward toward completion of the 140-foot paraboloid which will be the facility's largest precision instrument. Already operational for several months is an 85-foot dish, with a growing research program to keep it busy. Here, too, has been reassembled that historic veteran of the still fledgling science—the 30-foot instrument which Grote Reber built single-handed in his backyard at Wheaton, Ill., in 1937, after he alone in the whole country and in the whole world had been inspired by Karl Jansky's writings on the discovery of radio astronomy a few years earlier. This is the dish with which Reber, an amateur, did brilliant pioneer work in following Jansky's lead for almost a decade while professional scientists failed to comprehend the profound significance of the breakthrough, and both he and Jansky were virtually prophets without honor in their own land. It is fortunate that Reber's antenna survives (like its zealous creator who is now 49 and still active in radio astronomy) and it is fitting that the array has been installed for preservation at this site. Incidentally, the old dish is still far from being a museum piece; it is very much in regular active use, contributing its share to the general research work of the observatory.

Centrally located in this scientific preserve which nestles in the Appalachians 200 miles west of Washington, D. C., is a long, two-story building, modernly austere in design and functional in appearance. This is the laboratory building, to be expanded later, which is the heart and brains of the whole observatory. It is to serve all radio telescopes the facility ever supports.

On the lawn, some distance from the building's entrance, a rectangular pile of neatly-fitted fieldstone rises from the turf. A flag staff stands behind and Old Glory leans on the soft June air. In the fieldstone marker a plain bronze marker has been inset, bearing this legend: KARL GUTHE JANSKY LABORATORY

Just the man's name; nothing more in the way of explanation. That is the only correct way when anything is dedicated in honor of a person deceased.

To learn why the man is being commemorated, step inside the laboratory building and there, by a portrait of him on the wall near the entrance, is another plain bronze plaque which tersely gives his story:

KARL GUTHE JANSKY (1905-1950)
FATHER OF THE SCIENCE OF RADIO ASTRONOMY
FIRST TO DISCOVER RADIO EMISSIONS
FROM OUTER SPACE AT
BELL TELEPHONE LABORATORIES
HOLMDEL, NEW JERSEY
IN 1932

Cyril M. Jansky, Jr., Karl's older brother.

And so, at long last, formal honor has come to the late Karl Jansky in this, his native land.

The actual dedication of the laboratory was to have been something of an occasion, with the ceremonies, tributes, and dignitaries traditional for such affairs. His brother, C. M. Jansky, Jr., was informally approached about participating. The wording for the two bronze plaques was carefully weighed, then selected, and they were ordered made. Delays in construction progress elsewhere on the observatory kept further arrangements pretty much up in the air. Actually, the planning never did emerge from the vague "idea" stage. A general feeling evidently prevailed that there would be plenty of time to work out the concrete details later.

No one seems to know just what happened. There was no authorization or directions that it be done. On the other hand no strict instructions had been issued against its being done. When the plaques arrived at the completed laboratory, a crew of masons methodically proceeded to build the fieldstone marker on the lawn. Other workers decided on the location of the picture and commemorative plaque inside the building.

So the laboratory was given Karl Jansky's name without fuss, fanfare or publicity by a little group of anonymous workmen who were concerned solely with doing their job and doing it well. When observatory officials awoke one day to what had happened, they were somewhat disconcerted. But no question of supervisory responsibility was involved, and there was no place to assign any blame. Of course, commemorative tablets are usually in place before a dedication and it would be perfectly proper to schedule the formal ceremonies for some future date. The officials thought it over and finally decided the matter was out of their hands: After all, the laboratory had been dedicated in due manner.

I rather believe that Karl Jansky is pleased and quite content they decided the way they did. From everything his older brother told me about him and what his former colleagues say, he was a quiet, genuine, and very modest person. And he always believed the important thing was getting the job done, and doing it well.

Airplanes and pilots alone do not constitute airlift. The function of Air Force tactical troop carrier squadrons is a professional military specialty demanding high standards of performance from the men who collectively manage the utilization of this vital component of military capability.

NO ROOM for AMATEURS

by TSgt. John K. O'Doherty, *Airman Staff*

HANNIBAL, the Carthaginian, crossed the Alps with a convoy of elephants to defeat the Romans in 221 B. C. Ever since, military strategists have wrestled with the problem of moving large numbers of troops and equipment rapidly from place to place. Nathan Bedford Forrest of the Confederacy placed a calloused finger on the crux of the matter when he described his formula for victory as: "Get there fustest with the mostest men."

By substituting a rather more inclusive term such as "firepower," or "combat capability" for the "mostest men," General Forrest's homey principle can still be applied to some functions of present-day tactical troop carrier units. But the whole concept of tactical airlift has been expanded in its evolution to include operations far more extensive than the simple traditional requirement for troop mobility.

Troop carrier airlift had its beginning in World War II, and airborne troops played an important role in the invasion of Sicily, the landing at Salerno, the liberation of Holland, and the assault on Normandy. It was particularly on the mainland of Asia, however, that the functions of troop transport, aerial supply, assault landings, and medical evacuation were combined and coordinated in an operation resembling to some degree the present-day mission of tactical troop carrier units.

In 1944 when British forces were beseiged by the Japanese at Imphal near the Burma-India border, troop carrier missions flown by the Royal Air Force and the USAAF turned what seemed a certain disaster into victory. In two and a half months from April to June nearly 30,000 noncombatants were evacuated from the area (reducing the requirement for rations), 20,000 tons of supplies were landed, 10,000 casualties airlifted out, and enough reinforcements brought in—more than 12,000 troops—to enable the garrison to crack the Japanese ring.

Though the designation "troop carrier" is now something of a misnomer—a heritage perhaps of the days when airpower was considered an incidental appendage of ground forces—combat airlift support for the Army is still a major responsibility of Tactical Air Command troop carrier wings, comprising as much as 50 percent of the mission in some units. Tactical airlift differs from the worldwide function of MATS in that it is essentially an intratheater operation providing air logistic and special mission services to tactical air forces as well as the troop carrier function for the Army. Missions conducted by MATS and the troop carrier units frequently overlap, since MATS capability is similar, if more extensive. The two are components of overall global airlift capability.

The burden of tactical airlift support in the United States is shouldered by the 464th Troop Carrier Wing (A) at Pope Air Force Base, N. C., and the 839th Air Division at Sewart AFB, Tenn.—both components of TAC's Ninth Air Force. Similar troop carrier organizations of appropriate size—notably the 322d Air Division in Europe and the 315th in the Pacific—serve the tactical commands overseas.

In their mission of support for Army operations and training, the units at Pope and Sewart work closely and in harmony with the XVIII Airborne Corps, headquarters of the Army's Strategic Army Corps at Fort Bragg, N. C. The concept of the Strategic Army Corps —or STRAC—in a nutshell, is based on readiness, highly concentrated firepower, and mobility. As the spearhead of the Army's combat forces, STRAC is intended to deliver striking power in the degree required by any situation. Dominant objective is to deal with limited war or any arrangement of circumstances that might lead to war. STRAC troops equipped with modern weapons and employing tactical airlift for assault landing or paradrop acquire unprecedented mobility and flexibility. In the airborne exercise Banyan Tree I it was demonstrated that troops can be airlifted overseas and paradropped directly into combat without additional staging in the overseas area. This important advance is made possible by high-speed, long-range aircraft specifically designed for the troop carrier mission.

Despite the value of this proven capability, experience has shown that where the situation and terrain permit it is preferable to airland troops and material at the scene of operations rather than drop them by parachute. The weight and bulk of parachutes, rigging, harness, and cushioning gear can reduce the capacity of the aircraft by one third. Paradrop capability for men, weapons, vehicles, and heavy equipment must be maintained for emergency, but the disadvantages render establishment of an airhead more satisfactory whenever possible.

Even at locations where runways or other facilities are not available, the feasibility of setting up an airhead in minimum time has been repeatedly demonstrated. In an exercise conducted in a forested area near Camp Breckenridge, Ky., in the fall of 1959, C-130 aircraft of the 839th Air Division paradropped 333 men of the 326th Airborne Engineer Battalion and their equipment into a completely unfamiliar area. The equipment included five tractors weighing more than 20,000 pounds each, a grader, two dump trucks, and 17,000 pounds of food and fuel. In 52 hours of round-the-clock operation an airstrip measuring 2,500 feet long by 60 feet wide was ready for use by troop carrier aircraft.

This type of airlift support provided to the Army for both paradrop and assault landings involves considerably more than supplying the aircraft and the crews to fly them. The package includes, among other things, contributions of Combat Airlift Support Units, Air Force units which coordinate Army requirements and move into the field with the troops to keep tab on aerial operations. Since upward of 20,000 paratroops of the Army are in constant training, planning, scheduling, and coordination must be precise. During an average typical week the Combat Airlift Support Unit at Pope AFB sets up about 200 flights for airborne troops at Fort Bragg.

In establishing an airhead either for assault landings or logistic support for a ground operation, Air Force combat controllers are first to parachute into the area.

The C-130 Hercules can land and take off from relatively primitive runways. In this test landing at Eglin AFB the 50-ton craft ploughed a 14-inch furrow in the sand.

These technicians, members of the troop carrier Aerial Port Squadrons, set up navigation aids and regulate air traffic in and out of the strip using portable air/ground radio communications and a variety of other signaling devices. A large number of combat controllers are master parachutists, meaning that they have 65 or more jumps logged, and have been in the business for at least five years. Dozens are members of the century club with over a hundred jumps, and several can point to as many as 250.

Every troop carrier plane flying cargo carries as crew member at least one loadmaster, an enlisted technician thoroughly versed in the characteristics and capabilities of the aircraft, and completely skilled in techniques of loading and unloading material of any type in any circumstances. Teams of aeromedical technicians, including doctors and nurses, make up a part of the troop carrier package. These people, too, are prepared to accompany the troops on assault landings, and the troop carrier aircraft can be quickly equipped with litters in the field for evacuation of wounded.

Support of CASF

Apart from the support service supplied to the Army, an important part of the tactical troop carrier mission in the United States is the airlift function comprising an integral part of TAC's Composite Air Strike Force. When the supersonic tactical fighters of Nineteenth Air Force are deployed to any part of the world, troop carrier aircraft accompany them as part of the team. Flyaway kits, spare parts, rations, and the most essential ingredient—maintenance personnel—transported by airlift make the CASF type of operation possible.

In the Middle East crisis of 1958, C-130s in support of CASF were on the ground at Adana, Turkey, 25 hours after the whistle blew. Aircrews at Sewart AFB like to remember that in the deployment to Formosa about a month later the C-130s arrived at their destination in advance of the jets thus earning for their crews first choice of available billets.

When TAC sent a goodwill mission to the Middle East last February, nine C-130s of the 463rd Troop Carrier Wing made the journey to support the 14 jet aircraft, and to participate in the program of static displays and flying demonstrations. This mission, named Operation Quickspan, was designed as a gesture of cooperation and support for the countries of the Central Treaty Organization, and produced an interesting sidelight in establishing a new record for the C-130. The lead aircraft—piloted by Col. George G. Norman, commander of the 463rd, and carrying Maj. Gen. Henry Viccellio, commander of Nineteenth Air Force as passenger—flew nonstop across the Atlantic from Seymour-Johnson AFB, N. C., to Moron in Spain, a distance of 3,483 miles in 10 hours, 45 minutes. (In a C-130B, more advanced version of the C-130A *Hercules*, Capt. Matthew R. Biggs of the 772d Troop Carrier Squadron flew 4,618 miles nonstop from Hickam AFB, Hawaii, to Dobbins AFB, Ga., at an average speed of 350 miles per hour and at altitudes up to 38,000 feet.)

The diversity and scope of troop carrier operations are illustrated by a glance at the status board of the 839th Air Division on a particular day. The chart for this specific point in time showed 44 aircraft deployed on 11 different missions at locations ranging all the way from Sondrestrom in Greenland and Lajes in the Azores to Duluth, Minn., Las Vegas, Nev., and an Army installation in southern Georgia.

Skis or Wheels

Tactical troop carrier capability was further expanded recently—and completely new horizons revealed to view—by the successful development of ski landing gear for the C-130. Air Research and Development Command performed the exploratory and creative work on this major advance which permits the 50-ton aircraft to take off and land either on skis or wheels. Twelve of the ski-equipped *Hercules* were delivered to the 61st Troop Carrier Squadron of the 839th Air Division and preliminary operational training was conducted in Minnesota.

The first major mission assigned to the ski craft called for a six-month tour at Sondrestrom AB, Greenland, beginning in April 1959 to support construction of the two most easterly sites of the Dew line, Dye One and Dye Two. Operation on the Greenland ice cap proved to be rather more complicated than training experience on a perfectly flat frozen lake at sea level. Constantly changing snow conditions, weather phenomena—including ground fog generated by engine heat in the intense cold—sometimes created conditions calling for on-the-spot improvisation; eroded snow formed treacherous gullies and hillocks. Dye Two, a pinpoint on the map

that could be reached only by dead reckoning, was situated 9,000 feet above sea level on the ice cap.

Cracked skis at first proved a major nightmare for personnel of the 314th CAM Squadron at the Sondrestrom base, but the problem was solved in short order by scraping the surface of frozen snow with a grader, modifying the technique used by pilots in takeoff and landing, and by careful calculation of optimum payload for the airplane in the circumstances. Subsequently more than 1,200 landings were made on the ice cap without malfunction.

When the mission was completed and its accomplishments analyzed in October, 1959, Col. Albert V. Andress, commander of the 839th Air Division, said that "airlift operations can be conducted to and from the Greenland ice cap on a sustained basis." There is little doubt but that the construction of Dye One and Dye Two would have been impossible in the time alloted by strategic factors without the support of tactical airlift. (An account of airlift missions on the ice cap appears in the May issue of THE AIRMAN under the title *The Air Force's Polar Push.)*

In January 1960, the C-130 ski craft and the 61st Troop Carrier Squadron participated in Operation Deep Freeze, the program of military support for the National Science Foundation post-IGY research in the Antarctic. The scope of the scientific effort was completely dependent from the outset on the degree of support that could be provided by the military. The Navy, management agency for military support, had suffered a series of unfortunate losses in dropping supplies and equipment to the stations by parachute—the only flaw in an otherwise magnificent performance. Seven C-130s from Sewart AFB moved in for two weeks TDY and air-landed 400 tons of supplies and equipment at the South Pole and Marie Byrd Land.

Five-engine aircraft. JATO bottles mounted four on each side give this ski-equipped* Hercules *the added power of an extra engine.

Radar sites in the wilds of Alaska depend on tactical troop carrier aircraft for support.

Lt. Col. Wilbur Turk, (left), commander of the 61st Troop Carrier Squadron, landed the first Hercules *at the South Pole. In center is Rear Adm. David M. Tyree, commander of the Navy's operation in the Anarctic.*

Altogether it is estimated by scientists that this troop carrier operation advanced the program of the National Science Foundation by at least a full year.

While this mission was going forward in the Antarctic, two other C-130s from the same squadron were flying out of Ladd AFB, Alaska, to rescue men and equipment from Ice Island Charlie which was breaking up in the Arctic Ocean about 400 miles off the coast of Point Barrow. Thirteen trips in all were made to the shrinking ice cake that had drifted out of the range of less powerful aircraft. Landings were made in the near-complete darkness of the Arctic winter, with only smouldering smudge pots to mark the remains of the airstrip on the ice. Originally the island measured about 25 miles long by 20 miles wide. When the last C-130 left the island there was only 3,800 feet of runway left, and only a few sagging, abandoned huts remained of the station.

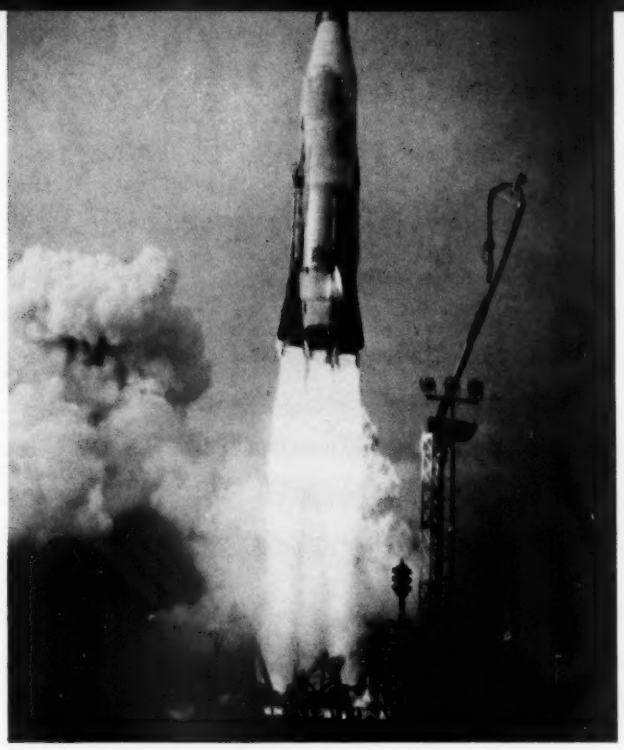
Special missions such as these are part of the day-to-day fare of the tactical troop carrier units. The requirements imposed by different assignments may vary all the way from dullest routine to the challenge of a situation never before encountered. But the machinery necessary to deal with any conceivable set of circumstances is kept polished and oiled by constant attention to professional readiness. This polishing process is accomplished on a continuing basis by the system of intra-command air logistics missions flown every day, every week, and every year with the regularity of time itself. Rugged functional aircraft, both the C-123 and the C-130 (backbone of tactical airlift), are specially designed for heavy-duty work, but it is the organization of men with their training and know-how that makes the system work. This is one facet of aerospace power that is exclusively military. It cannot be otherwise, any more than one can set himself up in the long-distance trucking business simply by stripping the cushioned seats out of a city bus.

THE RUSSIANS INVENTED IT

When the airplane began to show definite promise of usefulness as a transportation vehicle back in the 1920s, a handful of classical strategists hastened to examine its possibilities as a better way to move troops. Russia exploited the thought quite vigorously in the beginning, and by 1930 was the only major power that believed in the practicality of employing paratroops. The earlier technique developed by Soviet airmen was ingenious, to say the least.

A TB-1 twin-engine bomber was modified by fitting a long, coffinlike box under each wing. Each box was intended to hold one Soviet soldier equipped with parachute and rifle. The bottom of the box was hinged, and secured by a spring catch—as on a trapdoor.

The paratroopers themselves had no control over their destiny once the aircraft left the ground. Trapdoors were under control of the pilot who maneuvered his craft over the target area, and then pulled a lever to spring the traps and release his two-man force. The performance made quite an impression in its day, and Soviet Commissar of War Voroshilov had this to say: "Parachuting is one phase of the field of aviation which has become a monopoly of the Soviet Union. Any surpassing of us is inconceivable."



WEAPONS OF DETERRENCE,

manned and unmanned, they are

PAIRED FOR PEACE

The operational B-52G is currently the USAF's primary manned strategic space weapon. A later H model, with increased engine performance, is under development. Nuclear-armed manned systems such as this complement the unmanned or missile type weapons. Although the two systems are designed for the same purpose, each has disadvantages neutralized by the other's advantages. The B-52 is flexible. It can hit several targets and return to fight again. Equipped with the GAM 77 *Hound Dog*, or later air-launched ballistic missiles, it attains the epitome of launch-site mobility. More important to its deterrent role, it can be recalled anytime between take-off and final strike.

The *Atlas* ICBM weapon system, because of its tremendous speed and altitude, is particularly valuable for rapid destruction of an enemy's strategic sites. The *Atlas* can travel more than 5,500 miles at speeds in excess of 15,000 miles per hour.

Manned and unmanned systems, armed with nuclear weapons, constitute formidable offensive weapons. Their capabilities for instantaneous and annihilative retaliation against an aggressor are effective deterrents to attack.

THE GREAT LESSON to be learned in the battered towns of England and the ruined cities of Germany is that the best way to win a war is to prevent it from occurring. That must be the ultimate end to which our best efforts are devoted. It has been suggested – and wisely so – that this objective is well served by insuring the strength and the security of the United States. The United States was founded and has since lived upon principles of tolerance, freedom, and good will at home and abroad. Strength based on these principles is no threat to world peace. Prevention of war will not come from neglect of strength or lack of foresight or alertness on our part. Those who contemplate aggression find encouragement in such neglect.

U. S. Strategic Bombing Survey, 1945.